

Draft Programmatic Environmental Impact Statement for

Solar Energy Development in Six Southwestern States



Volume 2

Chapter 8: Arizona Proposed Solar Energy Zones

On the cover:

Typical Solar Fields for Various Technology Types (clockwise from upper left):
Solar Parabolic Trough (Source: Hosoya et al. 2008),
Solar Power Tower (Credit: Sandia National Laboratories. Source: NREL 2010a),
Photovoltaic (Credit: Arizona Public Service. Source: NREL 2010b), and
Dish Engine (Credit: R. Montoya. Source: Sandia National Laboratories 2008).
Reference citations are available in Chapter 1.

Background photo: Parabolic trough facility from an elevated viewpoint
(Credit: Argonne National Laboratory)

Draft Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States (DES 10-59; DOE/EIS-0403)

Responsible Agencies: The U.S. Department of the Interior (DOI) Bureau of Land Management (BLM) and the U.S. Department of Energy (DOE) are co-lead agencies. Nineteen cooperating agencies participated in the preparation of this PEIS: U.S. Department of Defense; U.S. Bureau of Reclamation; U.S. Fish and Wildlife Service; U.S. National Park Service; U.S. Environmental Protection Agency, Region 9; U.S. Army Corps of Engineers, South Pacific Division; Arizona Game and Fish Department; California Energy Commission; California Public Utilities Commission; Nevada Department of Wildlife; N-4 Grazing Board, Nevada; Utah Public Lands Policy Coordination Office; Clark County, Nevada, including Clark County Department of Aviation; Dona Ana County, New Mexico; Esmeralda County, Nevada; Eureka County, Nevada; Lincoln County, Nevada; Nye County, Nevada; and Saguache County, Colorado.

Locations: Arizona, California, Colorado, Nevada, New Mexico, and Utah.

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Abstract: The BLM and DOE are considering taking actions to facilitate solar energy development in compliance with various orders, mandates, and agency policies. For the BLM, these actions include the evaluation of a new BLM Solar Energy Program applicable to all utility-scale solar energy development on BLM-administered lands in six southwestern states (Arizona, California, Colorado, Nevada, New Mexico, and Utah). For DOE, they include the evaluation of developing new program guidance relevant to DOE-supported solar projects. The Draft PEIS assesses the environmental, social, and economic effects of the agencies' proposed actions and alternatives.

For the BLM, the Draft PEIS analyzes a no action alternative, under which solar energy development would continue on BLM-administered lands in accordance with the terms and conditions of the BLM's existing solar energy policies, and two action alternatives for implementing a new BLM Solar Energy Program. Under the solar energy development program alternative (BLM's preferred alternative), the BLM would establish a new Solar Energy Program of administration and authorization policies and required design features and would exclude solar energy development from certain BLM-administered lands. Under this alternative, approximately 22 million acres of BLM-administered lands would be available for right-of-way (ROW) application. A subset of these lands, about 677,400 acres, would be identified as solar energy zones (SEZs), or areas where the BLM would prioritize solar energy and associated transmission infrastructure development. Under the SEZ program alternative, the same policies and design features would be adopted, but development would be excluded from all BLM-administered lands except those located within the SEZs.

For DOE, the Draft PEIS analyzes a no action alternative, under which DOE would continue to conduct environmental reviews of DOE-funded solar projects on a case-by-case basis, and one action alternative, under which DOE would develop programmatic guidance to further integrate environmental considerations into its analysis and selection of solar projects that it will support.

The EPA Notice of Availability (NOA) of the Draft PEIS was published in the *Federal Register* on December 17, 2010. Comments on the Draft PEIS are due by March 17, 2011.

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Reader's Guide

The detailed analysis of the proposed solar energy zones (SEZs) in Arizona, provided in Sections 8.1 through 8.3, will be used to inform BLM decisions regarding the size, configuration, and/or management of these SEZs. These sections also include proposed mitigation requirements (termed "SEZ-specific design features"). Please note that the SEZ-specific summaries of Affected Environment use the descriptions of Affected Environment for the six-state study area presented in Chapter 4 of the PEIS as a basis. Also note that the SEZ-specific design features have been proposed with consideration of the general impact analyses for solar energy facilities presented in Chapter 5, and on the assumption that all programmatic design features presented in Appendix A, Section A.2.2, will be required for projects that will be located within the SEZs.

BLM will implement its SEZ-specific decisions through the BLM Record of Decision for the Final PEIS. Comments received during the review period for the Draft PEIS will inform BLM decisions.

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NOTATION

The following is a list of acronyms and abbreviations, chemical names, and units of measure used in this document. Some acronyms used only in tables may be defined only in those tables.

GENERAL ACRONYMS AND ABBREVIATIONS

AADT	annual average daily traffic
AASHTO	American Association of State Highway and Transportation Officials
AC	alternating current
ACC	air-cooled condenser
ACEC	Area of Critical Environmental Concern
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AERMOD	AMS/EPA Regulatory Model
AFC	Application for Certification
AGL	above ground level
AIRFA	American Indian Religious Freedom Act
AMA	active management area
AML	animal management level
ANHP	Arizona National Heritage Program
APE	area of potential effect
APLIC	Avian Power Line Interaction Committee
APP	Avian Protection Plan
AQCR	Air Quality Control Region
AQRV	air quality-related value
ARB	Air Resources Board
ARRA	American Recovery and Reinvestment Act of 2009
ARRTIS	Arizona Renewable Resource and Transmission Identification Subcommittee
ARS	Agricultural Research Service
ARZC	Arizona and California
ATSDR	Agency for Toxic Substances and Disease Registry
AUM	animal unit month
AVWS	Audio Visual Warning System
AWBA	Arizona Water Banking Authority
AWEA	American Wind Energy Association
AWRM	Active Water Resource Management
AZ DOT	Arizona Department of Transportation
AZDA	Arizona Department of Agriculture
AZGFD	Arizona Game and Fish Department
AZGS	Arizona Geological Survey

1	BA	biological assessment
2	BAP	base annual production
3	BEA	Bureau of Economic Analysis
4	BISON-M	Biota Information System of New Mexico
5	BLM	Bureau of Land Management
6	BMP	best management practice
7	BNSF	Burlington Northern Santa Fe
8	BO	biological opinion
9	BOR	U.S. Bureau of Reclamation
10	BPA	Bonneville Power Administration
11	BRAC	Blue Ribbon Advisory Council on Climate Change
12	BSE	Beacon Solar Energy
13	BSEP	Beacon Solar Energy Project
14	BTS	Bureau of Transportation Statistics
15		
16	CAA	Clean Air Act
17	CAAQS	California Air Quality Standards
18	Caltrans	California Department of Transportation
19	C-AMA	California-Arizona Maneuver Area
20	CAP	Central Arizona Project
21	CARB	California Air Resources Board
22	CAReGAP	California Regional Gap Analysis Project
23	CASQA	California Stormwater Quality Association
24	CASTNET	Clean Air Status and Trends NETwork
25	CAWA	Colorado Agricultural Water Alliance
26	CCC	Civilian Conservation Corps
27	CDC	Centers for Disease Control and Prevention
28	CDCA	California Desert Conservation Area
29	CDFG	California Department of Fish and Game
30	CDOT	Colorado Department of Transportation
31	CDOW	Colorado Division of Wildlife
32	CDPHE	Colorado Department of Public Health and Environment
33	CDWR	California Department of Water Resources
34	CEC	California Energy Commission
35	CEQ	Council on Environmental Quality
36	CES	constant elasticity of substitution
37	CESA	California Endangered Species Act
38	CESF	Carrizo Energy Solar Farm
39	CFR	<i>Code of Federal Regulations</i>
40	CGE	computable general equilibrium
41	CIRA	Cooperative Institute for Research in the Atmosphere
42	CLFR	compact linear Fresnel collector
43	CPC	Center for Plant Conservation
44	CNDDDB	California Natural Diversity Database
45	CNEL	community noise equivalent level
46	CNHP	Colorado National Heritage Program

1	Colorado DWR	Colorado Department of Water Resources
2	CPUC	California Public Utilities Commission
3	CPV	concentrating photovoltaic
4	CRBSCF	Colorado River Basin Salinity Control Forum
5	CREZ	competitive renewable energy zone
6	CRSCP	Colorado River Salinity Control Program
7	CSA	Candidate Study Area
8	CSC	Coastal Services Center
9	CSFG	carbon-sequestration fossil generation
10	CSP	concentrating solar power
11	CSQA	California Stormwater Quality Association
12	CSRI	Cultural Systems Research, Incorporated
13	CTG	combustion turbine generator
14	CTPG	California Transmission Planning Group
15	CTSR	Cumbres & Toltec Scenic Railroad
16	CUP	Conditional Use Permit
17	CVP	Central Valley Project
18	CWA	Clean Water Act
19	CWCB	Colorado Water Conservation Board
20	CWHR	California Wildlife Habitat Relationship System
21		
22	DC	direct current
23	DHS	U.S. Department of Homeland Security
24	DNA	Determination of NEPA Adequacy
25	DNI	direct normal insulation
26	DNL	day-night average sound level
27	DoD	U.S. Department of Defense
28	DOE	U.S. Department of Energy
29	DOI	U.S. Department of the Interior
30	DOL	U.S. Department of Labor
31	DOT	U.S. Department of Transportation
32	DRECP	California Desert Renewable Energy Conservation Plan
33	DSM	demand side management
34	DTC/C-AMA	Desert Training Center/California–Arizona Maneuver Area
35	DWMA	Desert Wildlife Management Area
36		
37	EA	environmental assessment
38	ECAR	East Central Area Reliability Coordination Agreement
39	ECOS	Environmental Conservation Online System (USFWS)
40	EERE	Energy Efficiency and Renewable Energy (DOE)
41	Eg	band gap energy
42	EIA	Energy Information Administration
43	EIS	environmental impact statement
44	EISA	Energy Independence and Security Act of 2007
45	EMF	electromagnetic field
46	E.O.	Executive Order

1	EPA	U.S. Environmental Protection Agency
2	EPRI	Electric Power Research Institute
3	EQIP	Environmental Quality Incentives Program
4	ERCOT	Electric Reliability Council of Texas
5	ERO	Electric Reliability Organization
6	ERS	Economic Research Service
7	ESA	Endangered Species Act of 1973
8	ESRI	Environmental Systems Research Institute
9		
10	FAA	Federal Aviation Administration
11	FBI	Federal Bureau of Investigation
12	FEMA	Federal Emergency Management Agency
13	FERC	Federal Energy Regulatory Commission
14	FHWA	Federal Highway Administration
15	FIRM	Flood Insurance Rate Map
16	FLPMA	Federal Land Policy and Management Act of 1976
17	FONSI	Finding of No Significant Impact
18	FR	<i>Federal Register</i>
19	FRCC	Florida Reliability Coordinating Council
20	FSA	Final Staff Assessment
21	FTE	full-time equivalent
22	FY	fiscal year
23		
24	G&TM	Generation and Transmission Modeling
25	GCRP	U.S. Global Climate Research Program
26	GDA	generation development area
27	GHG	greenhouse gas
28	GIS	geographic information system
29	GPS	global positioning system
30	GTM	Generation and Transmission Model
31	GUAC	Groundwater Users Advisory Council
32	GWP	global warming potential
33		
34	HA	herd area
35	HAP	hazardous air pollutant
36	HAZCOM	hazard communication
37	HCE	heat collection element
38	HCP	Habitat Conservation Plan
39	HMA	Herd Management Area
40	HMMH	Harris Miller Miller & Hanson, Inc.
41	HRSG	heat recovery steam generator
42	HSPD	Homeland Security Presidential Directive
43	HTF	heat transfer fluid
44	HVAC	heating, ventilation, and air-conditioning
45		
46		

1	I	Interstate
2	IARC	International Agency for Research on Cancer
3	IBA	important bird area
4	ICE	internal combustion engine
5	ICWMA	Imperial County Weed Management Area
6	IEC	International Electrochemical Commission
7	IFR	instrument flight rule
8	IID	Imperial Irrigation District
9	IM	Instruction Memorandum
10	IMPS	Iron Mountain Pumping Station
11	IMS	interim mitigation strategy
12	INA	Irrigation Non-Expansion Area
13	IOP	Interagency Operating Procedure
14	IOU	investor-owned utility
15	IPPC	Intergovernmental Panel on Climate Change
16	ISA	Independent Science Advisor; Instant Study Area
17	ISB	Intermontane Seismic Belt
18	ISCC	integrated solar combined cycle
19	ISDRA	Imperial Sand Dunes Recreation Area
20	ISEGS	Ivanpah Solar Energy Generating System
21	ITP	incidental take permit
22	IUCNNR	International Union for Conservation of Nature and Natural Resources
23	IUCNP	International Union for Conservation of Nature Pakistan
24		
25	KGA	known geothermal resources area
26	KML	keyhole markup language
27	KOP	key observation point
28	KSLA	known sodium leasing area
29		
30	LCC	Landscape Conservation Cooperative
31	LCOE	levelized cost of energy
32	L _{dn}	day-night average sound level
33	LDWMA	Low Desert Weed Management Area
34	L _{eq}	equivalent sound pressure level
35	LLA	limited land available
36	LLRW	low-level radioactive waste (waste classification)
37	LRG	Lower Rio Grande
38	LSA	lake and streambed alteration
39	LSE	load-serving entity
40	LTVA	long-term visitor area
41		
42	MAAC	Mid-Atlantic Area Council
43	MAIN	Mid-Atlantic Interconnected Network
44	MAPP	methyl acetylene propadiene stabilizer; Mid-Continent Area Power Pool
45	MCAS	Marine Corps Air Station
46	MCL	maximum contaminant level

1	MFP	Management Framework Plan
2	MIG	Minnesota IMPLAN Group
3	MLA	maximum land available
4	MOA	military operating area
5	MOU	Memorandum of Understanding
6	MPDS	maximum potential development scenario
7	MRA	Multiple Resource Area
8	MRI	Midwest Research Institute
9	MRO	Midwest Reliability Organization
10	MSDS	Material Safety Data Sheet
11	MSL	mean sea level
12	MTR	military training route
13	MWA	Mojave Water Agency
14	MWD	Metropolitan Water District
15	MWMA	Mojave Weed Management Area
16		
17	NAAQS	National Ambient Air Quality Standards
18	NADP	National Atmospheric Deposition Program
19	NAGPRA	Native American Graves Protection and Repatriation Act
20	NAHC	Native American Heritage Commission (California)
21	NAIC	North American Industrial Classification System
22	NASA	National Aeronautics and Space Administration
23	NCA	National Conservation Area
24	NCCAC	Nevada Climate Change Advisory Committee
25	NCDC	National Climatic Data Center
26	NCES	National Center for Education Statistics
27	NDCNR	Nevada Department of Conservation and Natural Resources
28	NDEP	Nevada Division of Environmental Protection
29	NDOT	Nevada Department of Transportation
30	NDOW	Nevada Department of Wildlife
31	NDWP	Nevada Division of Water Planning
32	NDWR	Nevada Division of Water Resources
33	NEAP	Natural Events Action Plan
34	NEC	National Electric Code
35	NED	National Elevation Database
36	NEP	Natural Events Policy
37	NEPA	National Environmental Policy Act of 1969
38	NERC	North American Electricity Reliability Corporation
39	NHA	National Heritage Area
40	NHNM	National Heritage New Mexico
41	NHPA	National Historic Preservation Act of 1966
42	NID	National Inventory of Dams
43	NM DOT	New Mexico Department of Transportation
44	NLCS	National Landscape Conservation System
45	NMAC	<i>New Mexico Administrative Code</i>
46	NMBGMR	New Mexico Bureau of Geology and Mineral Resources

1	NMDGF	New Mexico Department of Game and Fish
2	NMED	New Mexico Environment Department
3	NMED-AQB	New Mexico Environment Department-Air Quality Board
4	NMFS	National Marine Fisheries Service
5	NMOSE	New Mexico Office of the State Engineer
6	NMSU	New Mexico State University
7	NNHP	Nevada Natural Heritage Program
8	NNL	National Natural Landmark
9	NNSA	National Nuclear Security Administration
10	NOA	Notice of Availability
11	NOAA	National Oceanic and Atmospheric Administration
12	NOI	Notice of Intent
13	NPDES	National Pollutant Discharge Elimination System
14	NP	National Park
15	NPL	National Priorities List
16	NPS	National Park Service
17	NRA	National Recreation Area
18	NRCS	Natural Resources Conservation Service
19	NREL	National Renewable Energy Laboratory
20	NRHP	<i>National Register of Historic Places</i>
21	NRS	<i>Nevada Revised Statutes</i>
22	NSC	National Safety Council
23	NSO	no surface occupancy
24	NSTC	National Science and Technology Council
25	NTS	Nevada Test Site
26	NTTR	Nevada Test and Training Range
27	NVCRS	Nevada Cultural Resources Inventory System
28	NV DOT	Nevada Department of Transportation
29	NWCC	National Wind Coordinating Committee
30	NWI	National Wetlands Inventory
31	NWPP	Northwest Power Pool
32	NWR	National Wildlife Refuge
33	NWSRS	National Scenic River System
34		
35	O&M	operation and maintenance
36	ODFW	Oregon Department of Fish and Wildlife
37	OHV	off-highway vehicle
38	ONA	Outstanding Natural Area
39	ORC	organic Rankine cycle
40	OSE/ISC	Office of the State Engineer/Interstate Stream Commission
41	OSHA	Occupational Safety and Health Administration
42	OTA	Office of Technology Assessment
43		
44	PA	Programmatic Agreement
45	PAD	Preliminary Application Document
46	PAH	polycyclic aromatic hydrocarbon

1	PAT	peer analysis tool
2	PCB	polychlorinated biphenyl
3	PCM	purchase change material
4	PCS	power conditioning system
5	PCU	power converting unit
6	PEIS	programmatic environmental impact statement
7	PFYC	potential fossil yield classification
8	PIER	Public Interest Energy Research
9	P.L.	Public Law
10	PLSS	Public Land Survey System
11	PM	particulate matter
12	PM _{2.5}	particulate matter with a mean aerodynamic diameter of 2.5 µm or less
13	PM ₁₀	particulate matter with a mean aerodynamic diameter of 10 µm or less
14	POD	plan of development
15	POU	publicly owned utility
16	PPA	Power Purchase Agreement
17	PPE	personal protective equipment
18	PSD	Prevention of Significant Deterioration
19	PURPA	Public Utility Regulatory Policy Act
20	PV	photovoltaic
21	PVID	Palo Verde Irrigation District
22	PWR	public water reserve
23		
24	QRA	qualified resource area
25		
26	R&I	relevance and importance
27	RCI	residential, commercial, and industrial (sector)
28	RCRA	Resource Conservation and Recovery Act of 1976
29	RD&D	research, development, and demonstration; research, development, and
30		deployment
31	RDBMS	Relational Database Management System
32	RDEP	Restoration Design Energy Project
33	REA	Rapid Ecoregional Assessment
34	REAT	Renewable Energy Action Team
35	REDI	Renewable Energy Development Infrastructure
36	ReEDS	Regional Energy Deployment System
37	REPG	Renewable Energy Policy Group
38	RETA	Renewable Energy Transmission Authority
39	RETAAC	Renewable Energy Transmission Access Advisory Committee
40	RETI	Renewable Energy Transmission Initiative
41	REZ	renewable energy zone
42	RF	radio frequency
43	RFC	Reliability First Corporation
44	RFDS	reasonably foreseeable development scenario
45	RGP	Rio Grande Project
46	RGWCD	Rio Grande Water Conservation District

1	RMP	Resource Management Plan
2	RMPA	Rocky Mountain Power Area
3	RMZ	Resource Management Zone
4	ROD	Record of Decision
5	ROI	region of influence
6	ROS	recreation opportunity spectrum
7	ROW	right-of-way
8	RPG	renewable portfolio goal
9	RPS	Renewable Portfolio Standard
10	RRC	Regional Reliability Council
11	RSEP	Rice Solar Energy Project
12	RSI	Renewable Systems Interconnection
13	RTTF	Renewable Transmission Task Force
14	RV	recreational vehicle
15		
16	SAAQS	State Ambient Air Quality Standards
17	SAMHSA	Substance Abuse and Mental Health Services Administration
18	SCADA	supervisory control and data acquisition
19	SCE	Southern California Edison
20	SCRMA	Special Cultural Resource Management Area
21	SDRREG	San Diego Regional Renewable Energy Group
22	SDWA	Safe Drinking Water Act of 1974
23	SEGIS	Solar Energy Grid Integration System
24	SEGS	Solar Energy Generating System
25	SEI	Sustainable Energy Ireland
26	SEIA	Solar Energy Industrial Association
27	SES	Stirling Energy Systems
28	SETP	Solar Energy Technologies Program (DOE)
29	SEZ	solar energy zone
30	SHPO	State Historic Preservation Office(r)
31	SIP	State Implementation Plan
32	SLRG	San Luis & Rio Grande
33	SMA	Special Management Area
34	SMP	suggested management practice
35	SNWA	Southern Nevada Water Authority
36	SPP	Southwest Power Pool
37	SRMA	Special Recreation Management Area
38	SSA	Socorro Seismic Anomaly
39	SSI	self-supplied industry
40	ST	solar thermal
41	STG	steam turbine generator
42	SUA	special use airspace
43	SWAT	Southwest Area Transmission
44	SWIP	Southwest Intertie Project
45	SWPPP	Stormwater Pollution Prevention Plan
46	SWReGAP	Southwest Regional Gap Analysis Project
47		

1	TAP	toxic air pollutant
2	TCC	Transmission Corridor Committee
3	TDS	total dissolved solids
4	TEPPC	Transmission Expansion Planning Policy Committee
5	TES	thermal energy storage
6	TSA	Transportation Security Administration
7	TSCA	Toxic Substances Control Act of 1976
8	TSDF	treatment, storage, and disposal facility
9	TSP	total suspended particulates
10		
11	UACD	Utah Association of Conservation Districts
12	UBWR	Utah Board of Water Resources
13	UDA	Utah Department of Agriculture
14	UDEQ	Utah Department of Environmental Quality
15	UDNR	Utah Department of Natural Resources
16	UDOT	Utah Department of Transportation
17	UDWQ	Utah Division of Water Quality
18	UDWR	Utah Division of Wildlife Resources
19	UGS	Utah Geological Survey
20	UNEP	United Nations Environmental Programme
21	UNPS	Utah Native Plant Society
22	UP	Union Pacific
23	UREZ	Utah Renewable Energy Zone
24	USACE	U.S. Army Corps of Engineers
25	USC	<i>United States Code</i>
26	USDA	U.S. Department of Agriculture
27	USFS	U.S. Forest Service
28	USFWS	U.S. Fish and Wildlife Service
29	USGS	U.S. Geological Survey
30	Utah DWR	Utah Division of Water Rights
31	UTTR	Utah Test and Training Range
32	UWS	Underground Water Storage, Savings and Replenishment Act
33		
34	VACAR	Virginia-Carolinas Subregion
35	VCRS	Visual Contrast Rating System
36	VFR	visual flight rule
37	VOC	volatile organic compound
38	VRI	Visual Resource Inventory
39	VRM	Visual Resource Management
40		
41	WA	Wilderness Area
42	WAPA	Western Area Power Administration
43	WECC	Western Electricity Coordinating Council
44	WECC CAN	Western Electricity Coordinating Council – Canada
45	WEG	wind erodibility group
46	WGA	Western Governors’ Association

1	WGFD	Wyoming Game and Fish Department
2	WHA	wildlife habitat area
3	WHO	World Health Organization
4	WRAP	Water Resources Allocation Program; Western Regional Air Partnership
5	WRCC	Western Regional Climate Center
6	WREZ	Western Renewable Energy Zones
7	WRI	Water Resources Research Institute
8	WSA	Wilderness Study Area
9	WSC	wildlife species of special concern
10	WSMR	White Sands Missile Range
11	WSR	Wild and Scenic River
12	WSRA	Wild and Scenic Rivers Act of 1968
13	WWII	World War II
14		
15	YPG	Yuma Proving Ground
16		
17	ZITA	zone identification and technical analysis
18	ZLD	zero liquid discharge
19		
20		

21 **CHEMICALS**

23	CH ₄	methane	NO ₂	nitrogen dioxide
24	CO	carbon monoxide	NO _x	nitrogen oxides
25	CO ₂	carbon dioxide		
26	CO _{2e}	carbon dioxide equivalent	O ₃	ozone
27				
28	H ₂ S	hydrogen sulfide	Pb	lead
29	Hg	mercury		
30			SF ₆	sulfur hexafluoride
31	N ₂ O	nitrous oxide	SO ₂	sulfur dioxide
32	NH ₃	ammonia	SO _x	sulfur oxides
33				

35 **UNITS OF MEASURE**

37	ac-ft	acre-foot (feet)	°F	degree(s) Fahrenheit
38	bhp	brake horsepower	ft	foot (feet)
39			ft ²	square foot (feet)
40	°C	degree(s) Celsius	ft ³	cubic foot (feet)
41	cf	cubic foot (feet)		
42	cfs	cubic foot (feet) per second	g	gram(s)
43	cm	centimeter(s)	gal	gallon(s)
44			GJ	gigajoule(s)
45	dB	decibel(s)	gpcd	gallon per capita per day
46	dba	A-weighted decibel(s)	gpd	gallon(s) per day

1	gpm	gallon(s) per minute	Mgal	million gallons
2	GW	gigawatt(s)	mi	mile(s)
3	GWh	gigawatt hour(s)	mi ²	square mile(s)
4	GWh/yr	gigawatt hour(s) per year	min	minute(s)
5			mm	millimeter(s)
6	h	hour(s)	MMt	million metric ton(s)
7	ha	hectare(s)	MPa	megapascal(s)
8	Hz	hertz	mph	mile(s) per hour
9			MW	megawatt(s)
10	in.	inch(es)	MWe	megawatt(s) electric
11			MWh	megawatt-hour(s)
12	J	joule(s)		
13			ppm	part(s) per million
14	K	degree(s) Kelvin	psi	pound(s) per square inch
15	kcal	kilocalorie(s)	psia	pound(s) per square inch absolute
16	kg	kilogram(s)		
17	kHz	kilohertz	rpm	rotation(s) per minute
18	km	kilometer(s)		
19	km ²	square kilometer(s)	s	second(s)
20	kPa	kilopascal(s)	scf	standard cubic foot (feet)
21	kV	kilovolt(s)		
22	kVA	kilovolt-ampere(s)	TWh	terawatt hours
23	kW	kilowatt(s)		
24	kWh	kilowatt-hour(s)	VdB	vibration velocity decibel(s)
25	kWp	kilowatt peak		
26			W	watt(s)
27	L	liter(s)		
28	lb	pound(s)	yd ²	square yard(s)
29			yd ³	cubic yard(s)
30	m	meter(s)	yr	year(s)
31	m ²	square meter(s)		
32	m ³	cubic meter(s)	µg	microgram(s)
33	mg	milligram(s)	µm	micrometer(s)

ENGLISH/METRIC AND METRIC/ENGLISH EQUIVALENTS

The following table lists the appropriate equivalents for English and metric units.

Multiply	By	To Obtain
<i>English/Metric Equivalents</i>		
acres	0.004047	square kilometers (km ²)
acre-feet (ac-ft)	1,234	cubic meters (m ³)
cubic feet (ft ³)	0.02832	cubic meters (m ³)
cubic yards (yd ³)	0.7646	cubic meters (m ³)
degrees Fahrenheit (°F) –32	0.5555	degrees Celsius (°C)
feet (ft)	0.3048	meters (m)
gallons (gal)	3.785	liters (L)
gallons (gal)	0.003785	cubic meters (m ³)
inches (in.)	2.540	centimeters (cm)
miles (mi)	1.609	kilometers (km)
miles per hour (mph)	1.609	kilometers per hour (kph)
pounds (lb)	0.4536	kilograms (kg)
short tons (tons)	907.2	kilograms (kg)
short tons (tons)	0.9072	metric tons (t)
square feet (ft ²)	0.09290	square meters (m ²)
square yards (yd ²)	0.8361	square meters (m ²)
square miles (mi ²)	2.590	square kilometers (km ²)
yards (yd)	0.9144	meters (m)
<i>Metric/English Equivalents</i>		
centimeters (cm)	0.3937	inches (in.)
cubic meters (m ³)	0.00081	acre-feet (ac-ft)
cubic meters (m ³)	35.31	cubic feet (ft ³)
cubic meters (m ³)	1.308	cubic yards (yd ³)
cubic meters (m ³)	264.2	gallons (gal)
degrees Celsius (°C) +17.78	1.8	degrees Fahrenheit (°F)
hectares (ha)	2.471	acres
kilograms (kg)	2.205	pounds (lb)
kilograms (kg)	0.001102	short tons (tons)
kilometers (km)	0.6214	miles (mi)
kilometers per hour (kph)	0.6214	miles per hour (mph)
liters (L)	0.2642	gallons (gal)
meters (m)	3.281	feet (ft)
meters (m)	1.094	yards (yd)
metric tons (t)	1.102	short tons (tons)
square kilometers (km ²)	247.1	acres
square kilometers (km ²)	0.3861	square miles (mi ²)
square meters (m ²)	10.76	square feet (ft ²)
square meters (m ²)	1.196	square yards (yd ²)

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1 **8 AFFECTED ENVIRONMENT AND IMPACT ASSESSMENT FOR**
2 **PROPOSED SOLAR ENERGY ZONES IN ARIZONA**

3
4
5 **8.1 BRENDA**

6
7
8 **8.1.1 Background and Summary of Impacts**

9
10
11 **8.1.1.1 General Information**

12
13 The proposed Brenda Solar Energy Zone (SEZ) is located in La Paz County in west-
14 central Arizona (Figure 8.1.1.1-1), 32 mi (52 km) east of the California border. The SEZ has a
15 total area of 3,878 acres (16 km²). In 2008, the county population was 20,005, while adjacent
16 Riverside County to the west in California had a population of 2,087,917. The towns of
17 Quartzsite and Salome in La Paz County are about 18 mi (29 km) west of, and 18 mi (29 km)
18 east of, the SEZ respectively. The Phoenix metropolitan area is approximately 100 mi (161 km)
19 to the east of the SEZ, and Los Angeles is approximately 230 mi (370 km) to the west.

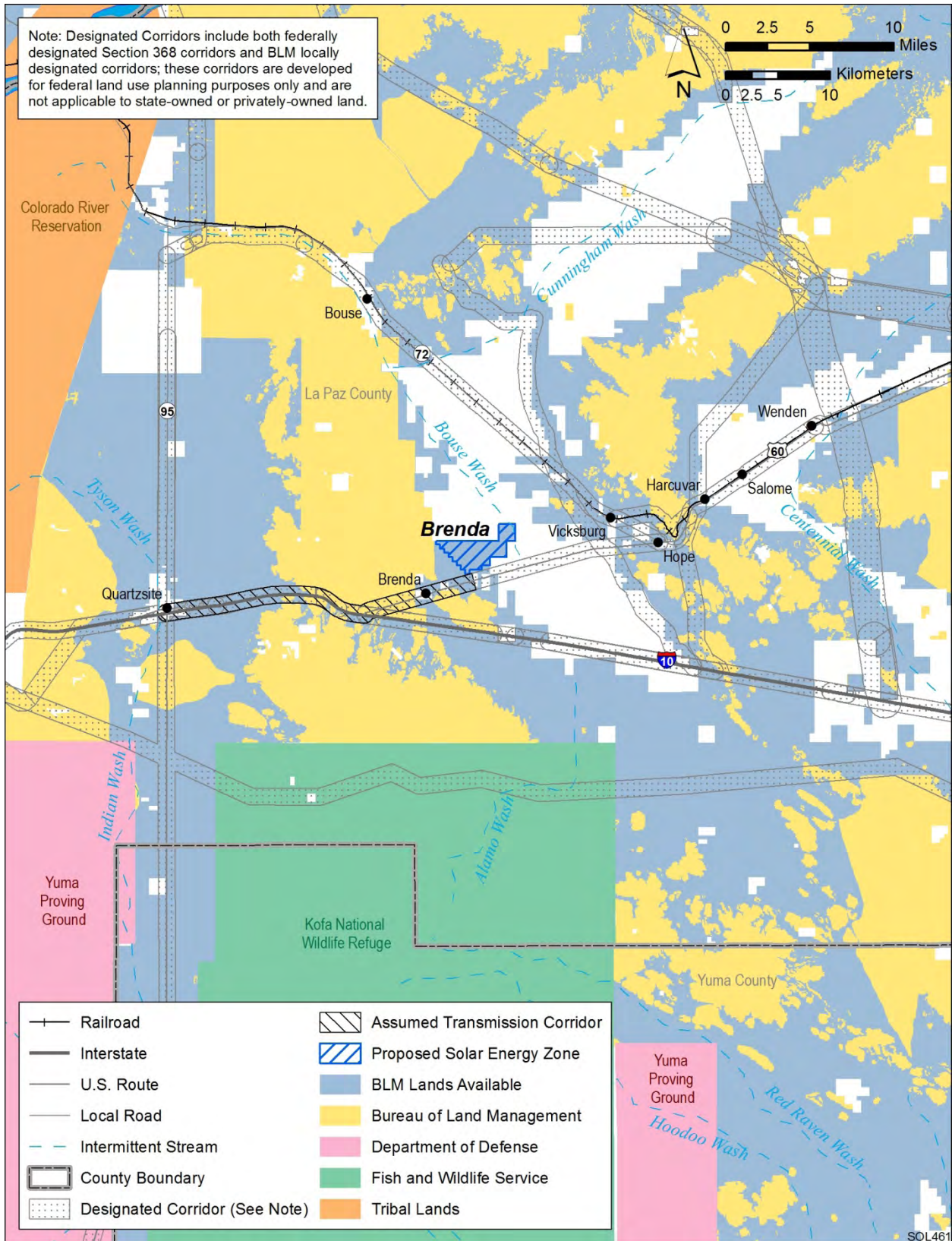
20
21 The nearest major road access to the SEZ is via U.S. 60, which runs southwest to
22 northeast, along the southeast border of the Brenda SEZ. The nearest railroad stop is 11 mi
23 (18 km) away. The nearest airports serving the area are the Blythe and Parker (Avi Suquilla)
24 Airports, both approximately 50 mi (80 km) from the SEZ, and neither of which have scheduled
25 commercial passenger service. The Sky Harbor Airport in Phoenix is 125 mi (201 km) to the
26 east, and Yuma International Airport in Yuma is 104 mi (167 km) to the south, of the SEZ.

27
28 A 161-kV transmission line passes 19 mi (31 km) west of the SEZ. It is assumed that a
29 new transmission line would be needed to provide access from the SEZ to the transmission grid
30 (see Section 8.1.1.1.2).

31
32 As of February 2010, there were no right-of-way (ROW) applications for solar projects
33 within the SEZ; however, there were many ROW applications for solar projects that would be
34 located within 50 mi (80 km) of the SEZ, including one categorized as a fast-track project. These
35 applications are discussed in Section 8.1.22.2.1.

36
37 The proposed Brenda SEZ is undeveloped and rural, with few permanent residents in the
38 area. The SEZ is located on the Ranegras Plain, bounded on the north by the Bouse Hills, on the
39 west-southwest by the Plomosa Mountains and the Bear Hills, and on the east by the Granite
40 Wash Mountains and Harquahala Mountains. Land within the SEZ is undeveloped scrubland
41 characteristic of a semiarid basin.

42
43 The proposed Brenda SEZ and other relevant information are shown in Figure 8.1.1.1-1.
44 The criteria used to identify the SEZ as an appropriate location for solar energy development
45 included proximity to existing transmission or designated corridors, proximity to existing roads,
46 and a slope of generally less than 2%. In addition, the area was identified as being relatively free



1

2 **FIGURE 8.1.1.1-1 Proposed Brenda SEZ**

1 of other types of conflicts, such as U.S. Fish and Wildlife Service (USFWS)-designated critical
2 habitat for threatened and endangered species, Areas of Critical Environmental Concern
3 (ACECs), Special Recreation Management Area (SRMAs), and National Landscape
4 Conservation System (NLCS) lands (see Section 2.2.2.2 for the complete list of exclusions).
5 Although these classes of restricted lands were excluded from the proposed Brenda SEZ, other
6 restrictions might be appropriate. The analyses in the following sections address the affected
7 environment and potential impacts associated with utility-scale solar energy development in the
8 proposed SEZ for important environmental, cultural, and socioeconomic resources.
9

10 As initially announced in the *Federal Register* on June 30, 2009, the proposed Brenda
11 SEZ encompassed 4,321 acres (17 km²). Subsequent to the study area scoping period, the
12 boundaries of the proposed Brenda SEZ were altered somewhat to facilitate the U.S. Department
13 of the Interior (DOI) Bureau of Land Management's (BLM's) administration of the SEZ area.
14 The revised SEZ is approximately 443 acres (1.8 km²) smaller than the original SEZ as
15 published in June 2009.
16
17

18 **8.1.1.2 Development Assumptions for the Impact Analysis** 19

20 Maximum solar development of the Brenda SEZ is assumed to be 80% of the SEZ area
21 over a period of 20 years, a maximum of 3,102 acres (13 km²). These values are shown in
22 Table 8.1.1.2-1, along with other development assumptions. Full development of the Brenda
23 SEZ would allow development of facilities with an estimated total of 345 MW of electrical
24 power capacity if power tower, dish engine, or photovoltaic (PV) technologies were used,
25 assuming 9 acres/MW (0.04 km²/MW) of land required, and an estimated 620 MW of power if
26 solar trough technologies were used, assuming 5 acres/MW (0.02 km²/MW) of land required.
27

28 Availability of transmission facilities from SEZs to load centers will be an important
29 consideration for future development in SEZs. The nearest existing transmission line is a 161-kV
30 line 19 mi (31 km) west of the SEZ. It is possible that a new transmission line could be
31 constructed from the SEZ to this existing line, but the 161-kV capacity of that existing line
32 would be inadequate for 345 to 620 MW of new capacity (note: a 500-kV line can accommodate
33 approximately the load of one 700-MW facility). If the SEZ was at full build-out capacity, it is
34 clear that new transmission and/or upgrades of existing transmission lines (in addition to or
35 instead of construction of a connection to the nearest existing line) would be required to bring
36 electricity from the proposed Brenda SEZ to load centers; however, at this time the location and
37 size of such new transmission facilities is unknown. Generic impacts of transmission and
38 associated infrastructure construction and of line upgrades for various resources are discussed in
39 Chapter 5. Project-specific analyses would need to identify the specific impacts of new
40 transmission construction and line upgrades for any projects proposed within the SEZ.
41

42 For purposes of as complete an analysis of impacts of development in the SEZ as
43 possible, it was assumed that, at a minimum, a transmission line segment would be constructed
44 from the proposed Brenda SEZ to the nearest existing transmission line to connect the SEZ to the
45 transmission grid (the route of this transmission line was assumed to follow the route of the
46 designated corridor that runs east-west along the SEZ's southern boundary; see Figure 8.1.1.1-1).

TABLE 8.1.1.2-1 Proposed Brenda SEZ—Assumed Development Acreages, Solar MW Output, Access Roads, and Transmission Line ROWs

Total Acreage and Assumed Developed Acreage (80% of Total)	Assumed Maximum SEZ Output for Various Solar Technologies	Distance to Nearest State, U.S. or Interstate Highway	Distance and Capacity of Nearest Existing Transmission Line	Assumed Area of Transmission Line ROW and Road ROW	Distance to Nearest Designated Corridor ^e
3,878 acres and 3,102 acres ^a	345 MW ^b and 620 MW ^c	U.S. 60 adjacent	19 mi ^d and 161 kV	575 acres and 0 acres	Adjacent

- ^a To convert acres to km², multiply by 0.004047.
- ^b Maximum power output if the SEZ were fully developed using power tower, dish engine, or PV technologies, assuming 9 acres/MW (0.04 km²/MW) of land required.
- ^c Maximum power output if the SEZ were fully developed using solar trough technologies, assuming 5 acres/MW (0.02 km²/MW) of land required.
- ^d To convert mi to km, multiply by 1.609.
- ^e BLM-designated corridors are developed for federal land use planning purposes only and are not applicable to state-owned or privately owned land.

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This assumption was made without additional information on whether the nearest existing transmission line would actually be available for connection of future solar facilities, and without assumptions about upgrades of the line. Establishing a connection to the line closest to the SEZ would involve the construction of about 19 mi (31 km) of new transmission line outside of the SEZ. The ROW for this transmission line would occupy approximately 575 acres (2.3 km²) of land, assuming a 250-ft (76-m) wide ROW. If a connecting transmission line were constructed to a different off-site grid location in the future, site developers would need to determine the impacts from construction and operation of that line. In addition, developers would need to determine the impacts of line upgrades, if they are needed.

Existing road access to the proposed Brenda SEZ should be adequate to support construction and operation of solar facilities, because U.S. 60 runs along the southeast border of the SEZ. Thus, no additional road construction outside of the SEZ was assumed to be required to support solar development.

8.1.1.3 Summary of Major Impacts and SEZ-Specific Design Features

In this section, the impacts and SEZ-specific design features assessed in Sections 8.1.2 through 8.1.21 for the proposed Brenda SEZ are summarized in tabular form. Table 8.1.1.3-1 is a comprehensive list of impacts discussed in these sections; the reader may reference the

TABLE 8.1.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Brenda SEZ and SEZ-Specific Design Features^a

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Lands and Realty	<p>Full development of the SEZ could disturb up to 3,102 acres (13 km²) and would establish a large industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Solar energy development would be a new and dominant land use in the area and may cause conflict with existing landowners of residential or commercial properties.</p> <p>Construction of new transmission facilities to connect solar facilities in the SEZ to the regional grid would disturb 575 acres (2.3 km²) of land.</p>	None.
Specially Designated Areas and Lands with Wilderness Characteristics	<p>Seven specially designated areas within 25 mi (40 km) of the proposed Brenda SEZ could be affected by solar energy development within the SEZ. The New Water and Kofa WAs, Dripping Springs ACEC, and Plomosa SRMA are the most likely areas to be adversely affected. Overall impacts to specially designated areas are expected to be minimal to low.</p>	To reduce potential impacts to the Plomosa SRMA consideration should be given to restricting solar energy development in the SEZ to areas east of the existing county road. Additionally, if the SEZ were restricted to the use of lower profile solar energy facilities, potential visual impacts would be reduced in the Plomosa SRMA, the Kofa and New Water WAs, and the Dripping Springs ACEC.
Rangeland Resources: Livestock Grazing	A maximum of 353 AUMs in the Crowder-Weisser allotment could be lost.	Development of range improvements and changes in grazing management should be considered to mitigate the loss of AUMs in the grazing allotment.
Rangeland Resources: Wild Horses and Burros	None.	None.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Recreation	Areas developed for solar energy production would be closed to recreational use. There is some potential for a loss of recreation use in portions of the Plomosa SRMA, the Kofa and New Water WAs, and the Dripping Springs ACEC.	To reduce potential impacts to recreation use in the Plomosa SRMA, consideration should be given to restricting solar energy development in the SEZ to areas east of the county road. Additionally, if the SEZ was restricted to the use of lower profile solar energy facilities, impacts to recreation use in the SRMA would likely be reduced.
Military and Civilian Aviation	The military has expressed concern that any development in the SEZ that exceeds 250 ft (76 m) in height would interfere with military operations in three MTRs. There would be no effect on civilian aviation facilities.	None.
Geologic Setting and Soil Resources	Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase. Impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. These impacts may be impacting factors for other resources (e.g., air quality, water quality, and vegetation).	None.
Minerals (fluids, solids, and geothermal resources)	None.	None.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Water Resources	<p data-bbox="497 363 1285 451">Ground-disturbance activities (affecting 77% of the total area in the peak construction year) could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills.</p> <p data-bbox="497 492 1285 548">Construction activities may require up to 2,014 ac-ft (2.5 million m³) of water during the peak construction year.</p> <p data-bbox="497 589 1285 646">Construction activities would generate as high as 74 ac-ft (91,000 m³) of sanitary wastewater.</p> <p data-bbox="497 686 1285 743">Assuming full development of the SEZ, operations would use the following amounts of water:</p> <ul data-bbox="533 784 1285 1279" style="list-style-type: none"> <li data-bbox="533 784 1285 906">• For parabolic trough facilities (620-MW capacity), 443 to 940 ac-ft/yr (546,000 to 1.2 million m³/yr) for dry-cooled systems; 3,111 to 9,316 ac-ft/yr (3.8 million to 11.5 million m³/yr) for wet-cooled systems. <li data-bbox="533 922 1285 1044">• For power tower facilities (345-MW capacity), 245 to 521 ac-ft/yr (302,000 to 643,000 m³/yr) for dry-cooled systems; 1,727 to 5,175 ac-ft/yr (2.1 million to 6.4 million m³/yr) for wet-cooled systems. <li data-bbox="533 1060 1285 1117">• For dish engine facilities (345-MW capacity), 176 ac-ft/yr (217,000 m³/yr). <li data-bbox="533 1141 1285 1198">• For PV facilities (345-MW capacity), 18 ac-ft/yr (22,000 m³/yr). <li data-bbox="533 1222 1285 1279">• Assuming full development of the SEZ, operations would generate up to 9 ac-ft/yr (11,000 m³/yr) of sanitary wastewater. 	<p data-bbox="1316 363 1892 451">Wet-cooling options would not be feasible. Other technologies should incorporate water conservation measures.</p> <p data-bbox="1316 492 1892 711">During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain.</p> <p data-bbox="1316 751 1892 873">Before drilling a new well within the Ranegras Plain basin, a Notice of Intent to Drill must be filed with ADWR, and any groundwater rights policy of the ADWR must be followed (ADWR 2010c).</p> <p data-bbox="1316 914 1892 971">Groundwater monitoring and production wells should be constructed in accordance with state standards.</p> <p data-bbox="1316 1011 1892 1133">Stormwater management plans and best management practices (BMPs) should comply with standards developed by the Arizona Department of Environmental Quality.</p> <p data-bbox="1316 1174 1892 1230">Water for potable uses would have to meet or be treated to meet drinking water quality standards.</p> <p data-bbox="1316 1271 1892 1346">Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site.</p>

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Vegetation ^b	<p>Up to 80% (3,102 acres [12.6 km²]) of the SEZ would be cleared of vegetation; re-establishment of shrub communities in disturbed areas would likely be very difficult because of the arid conditions.</p> <p>Noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats; thus, reducing restoration success and potentially resulting in widespread habitat degradation.</p> <p>The deposition of fugitive dust from large areas of disturbed soil onto habitats outside a solar project area could result in reduced productivity or changes in plant community composition.</p> <p>Grading could affect dry washes within the SEZ and transmission line corridor. Alteration of surface drainage patterns or hydrology could adversely affect downstream dry wash communities and intermittently flooded areas.</p>	<p>An Integrated Vegetation Management Plan, addressing invasive species control, and an Ecological Resources Mitigation and Monitoring Plan, addressing habitat restoration, should be approved and implemented to increase the potential for successful restoration of creosotebush–white bursage desert scrub communities and other affected habitats and to minimize the potential for the spread of noxious weeds or invasive species, such as those occurring in Le Paz County or the Lake Havasu Field Office Planning Area, that could be introduced as a result of solar energy project activities (see Section 8.1.10.2.2). To reduce the use of herbicides, invasive species control should focus on biological and mechanical methods where possible.</p> <p>All dry wash, dry wash woodland, chenopod scrub habitats, and saguaro cactus communities within the SEZ and all dry wash, dry wash woodland, mesquite bosque, chenopod scrub, and saguaro cactus communities within the assumed transmission line corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around dry washes, dry wash woodland, and mesquite bosque habitats to reduce the potential for impacts.</p> <p>Appropriate engineering controls should be used to minimize impacts on dry wash, dry wash woodland, mesquite bosque, and chenopod scrub, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust</p>

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Vegetation ^b (Cont.)		<p>deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation.</p> <p>Transmission line towers should be sited and constructed to minimize impacts on dry washes, dry wash woodlands, and mesquite bosque communities; towers should span such areas whenever practicable.</p> <p>Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities.</p>
Wildlife: Amphibians and Reptiles ^b	<p>Direct impacts on amphibians and reptiles from development on the SEZ would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region). With the implementation of proposed design features, indirect impacts would be expected to be negligible.</p>	<p>Bouse Wash should be avoided by solar energy development and Tyson Wash should be spanned by the transmission line.</p>
Wildlife: Birds ^b	<p>Direct impacts on bird species would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region).</p> <p>Other impacts on birds could result from collision with vehicles and infrastructure (e.g., buildings and fences), surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. These indirect impacts are expected to be negligible with the implementation of design features.</p>	<p>The requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed.</p> <p>Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and the Arizona Game and Fish Department. A permit may be required under the Bald and Golden Eagle Protection Act.</p> <p>Bouse Wash and Tyson Wash should be avoided by solar energy development or spanned by transmission line development, respectively.</p>

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Wildlife: Mammals ^b	<p>Direct impacts on big game, small game, furbearers, and small mammals from habitat disturbance and long-term habitat reduction/fragmentation would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region).</p> <p>In addition to habitat loss, other direct impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and harassment. These indirect impacts are expected to be negligible with the implementation of design features.</p>	<p>The fencing around the solar energy facility should not block the free movement of mammals, particularly big game species.</p> <p>Bouse Wash and Tyson Wash should be avoided by solar energy development or spanned by transmission line development, respectively.</p>
Aquatic Biota ^b	No perennial streams, water bodies, seeps, or springs are present in the areas of direct or indirect effects for the proposed Brenda SEZ or within the area of the presumed new transmission line corridor. Ephemeral streams may cross the SEZ, but these drainages only contain water following rainfall and typically do not support wetland or riparian habitats.	All aquatic habitats within the SEZ (e.g., Bouse Wash) should be avoided to the extent practicable.
Special Status Species ^b	Potentially suitable habitat for 20 special status species occurs in the affected area of the Brenda SEZ. For all of these special status species, less than 1% of the potentially suitable habitat in the region occurs in the area of direct effects.	Pre-disturbance surveys should be conducted within the area of direct effects to determine the presence and abundance of special status species. Disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible for some species, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Special Status Species ^b (Cont.)		<p>Avoiding or minimizing disturbance of sand dunes, sand transport systems, sand flats, agricultural and riparian habitats in the area of direct effects could reduce impacts on two special status species.</p> <p>Consultation with the USFWS and the AZGFD should be conducted to address the potential for impacts on the Sonoran population of bald eagle, a species listed as threatened under the ESA and CESA. Consultation would identify an appropriate survey protocol, avoidance measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements.</p> <p>Coordination with the USFWS and AZGFD should be conducted to address the potential for impacts on the Sonoran population of the desert tortoise—a species under review for listing under the ESA. Coordination would identify an appropriate survey protocol, and mitigation requirements, which may include avoidance, minimization, translocation, or compensation.</p> <p>Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and AZGFD.</p>

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Air Quality and Climate	<p><i>Construction:</i> Temporary exceedances of AAQS for 24-hour and annual PM₁₀ and PM_{2.5} concentration levels at the SEZ boundaries and in the immediate surrounding area, which encompasses the nearby residences (trailers) at Pioneer (about 0.4 mi [0.6 km] south of the SEZ). Higher concentrations would be limited to the immediate area surrounding the SEZ boundary and would decrease quickly with distance. Modeling indicates that emissions from construction activities are not anticipated to exceed Class I PSD PM₁₀ increments at the nearest federal Class I area (Joshua Tree NP in California). In addition, construction emissions (primarily NO_x emissions) from the engine exhaust from heavy equipment and vehicles could cause some impacts on AQRVs (e.g., visibility and acid deposition) at the nearest federal Class I area.</p> <p><i>Operations:</i> Positive impact due to avoided emission of air pollutants from combustion-related power generation: 0.87 to 1.6% of total emissions of SO₂, NO_x, Hg, and CO₂ from electric power systems in the state of Arizona avoided (up to 837 tons/yr SO₂, 1,289 tons/yr NO_x, 0.012 ton/yr Hg, and 924,000 tons/yr CO₂).</p>	None.
Visual Resources	<p>Solar development could produce large visual impacts on the SEZ and surrounding lands within the SEZ viewshed due to major modification of the character of the existing landscape.</p> <p>The SEZ is in an area of low scenic quality, with cultural disturbances already present. Residents, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads. The residents nearest to the SEZ could be subjected to large visual impacts from solar energy development within the SEZ.</p>	None.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Visual Resources (Cont.)	<p>The SEZ is located 0.1 mi (0.2 km) from the Plomosa SRMA. Because of the open views of the SEZ and elevated viewpoints, weak to strong visual contrasts could be observed by SRMA visitors.</p> <p>The SEZ is located 2.3 mi (3.6 km) from the community of Brenda. Moderate to strong visual contrasts could be observed by residents of Brenda.</p> <p>The SEZ is located 2.5 mi (4.0 km) from the community of Hope, and 5.8 mi (9.3 km) from the community of Vicksburg. Weak to moderate visual contrasts could be observed by residents of Hope and Vicksburg.</p> <p>U.S. 60 passes within 0.4 mi (0.7 km) and is in the viewshed of the SEZ for about 20 mi (32 km). Because of the close proximity of U.S. 60 to the SEZ, strong visual contrasts could be observed by travelers on U.S. 60.</p> <p>I-10 passes within 3.3 mi (5.3 km) and is in the viewshed of the SEZ for about 19.7 mi (31.7 km). Moderate to strong visual contrasts could be observed by travelers on I-10.</p>	

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Acoustic Environment	<p><i>Construction.</i> Estimated noise levels at the nearest residences (0.3 mi [0.5 km] southeast of the SEZ boundary) would be about 55 dBA, which is well above the typical daytime mean rural background level of 40 dBA. However, this noise might be masked by road traffic on U.S. 60 to some extent. In addition, an estimated 51-dBA L_{dn} at these residences is below the EPA guidance of 55 dBA L_{dn} for residential areas.</p> <p><i>Operations.</i> For operation of a parabolic trough or power tower facility located near the southern SEZ boundary, the predicted noise level would be about 47 dBA at the nearest residences, which is higher than the typical daytime mean rural background level of 40 dBA. However, this noise might be masked by road traffic on U.S. 60 to some extent. If the operation were limited to daytime, 12 hours only, a noise level of about 45 dBA L_{dn} would be estimated for the nearest residences, which is well below the EPA guideline of 55 dBA L_{dn} for residential areas. However, in the case of 6-hour TES, the estimated nighttime noise level at the nearest residences would be 57 dBA, which is well above the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 58 dBA L_{dn}, which is above the EPA guideline of 55 dBA L_{dn} for residential areas.</p> <p>If 80% of the SEZ were developed with dish engine facilities, the estimated noise level at the nearest residences would be about 51 dBA, which is above the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 49 dBA L_{dn} at these residences would be below the EPA guideline of 55 dBA L_{dn} for residential areas.</p>	<p>Noise levels from cooling systems equipped with TES should be managed so that levels at the nearby residences to the southern SEZ boundary along U.S. 60 are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers.</p> <p>Dish engine facilities within the Brenda SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearby residences (i.e., the facilities should be located in the northern portion of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at nearby residences.</p>
Paleontological Resources	<p>The potential for impacts on significant paleontological resources in the proposed SEZ is unknown. A more detailed investigation of the alluvial deposits is needed prior to project approval. A paleontological survey will likely be needed.</p>	<p>The need for and the nature of any SEZ-specific design features would depend on the results of future paleontological investigations.</p>

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Cultural Resources	<p>The proposed SEZ has the potential for containing prehistoric sites, especially in the eastern portion of the SEZ, and the potential also exists for historic resources. Direct impacts on significant cultural resources could occur in the proposed Brenda SEZ; however, further investigation is needed. A cultural resources survey of the entire area of potential effects of any project proposed would first need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would need to follow to determine whether any are eligible for listing in the NRHP.</p> <p>Impacts on cultural resources also are possible in areas related to the transmission line ROW, as new areas of potential cultural significance could be directly affected by construction or opened to increased access from use.</p>	<p>SEZ-specific design features would be determined during consultations with the Arizona SHPO and affected Tribes and would depend on the findings of cultural surveys.</p>
Native American Concerns	<p>To date, no comments have been received from the Tribes specifically referencing the proposed Brenda SEZ. However, in a response letter, the Quechan Indian Tribe of Fort Yuma indicated that some of the SEZs proposed in this PEIS lie within their Tribal Traditional Use Area. They stressed the importance of evaluating impacts on landscapes as a whole.</p> <p>Commenting on past transmission line projects in the area, Native American groups have expressed a general mistrust of irreversible development projects because of the loss of natural habitat, particularly as it would affect eagle, deer, and bighorn sheep populations and wild plant resources.</p> <p>As consultation with the Tribes continues and project-specific analyses are undertaken, it is possible that Native Americans will express concerns over potential visual effects of solar energy development within the SEZ on the landscape.</p>	<p>The need for and nature of SEZ-specific design features would be determined during government-to-government consultation with the affected Tribes.</p>

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Socioeconomics	<p><i>Construction:</i> 396 to 5,245 total jobs; \$23.4 million to \$309 million income in ROI for construction of solar facilities in the SEZ.</p> <p><i>Operations:</i> 9 to 217 annual total jobs; \$0.3 million to \$8.1 million annual income in the ROI.</p> <p><i>Construction of new transmission line:</i> 98 total jobs, \$5.1 million income.</p>	None.
Environmental Justice	There are minority and low-income populations, as defined by CEQ guidelines, within the 50-mi (80-km) radius around the boundary of the SEZ. Therefore, any adverse impacts of solar projects, although likely to be small, could disproportionately affect minority and low-income populations.	None.
Transportation	The primary transportation impacts are anticipated to be from commuting worker traffic. Single projects could involve up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). This additional volume of traffic on U.S. 60 would represent an increase in traffic of about 130% in the area of the Brenda SEZ for a single project.	None.

Abbreviations: AAQS = ambient air quality standards; AQRV = air quality-related value; AZGFD = Arizona Game and Fish Department; BLM = Bureau of Land Management; BMP = best management practice; CEQ = Council on Environmental Quality; CO₂ = carbon dioxide; dBA = A-weighted decibel; DoD = U.S. Department of Defense; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; L_{dn} = day-night average sound level; MTR = military training route; NO_x = nitrogen oxides; NP = National Park; NRHP = *National Register of Historic Places*; PEIS = programmatic environmental impact statement; PM_{2.5} = particulate matter with an aerodynamic diameter of 2.5 μm or less; PM₁₀ = particulate matter with an aerodynamic diameter of 10 μm or less; PSD = prevention of significant deterioration; PV = photovoltaic; ROI = region of influence; ROW = right-of-way; SEZ = solar energy zone; SHPO = State Historic Preservation Office; SO₂ = sulfur dioxide; SRMA = Special Recreation Management Area; TES = thermal energy storage; USFWS = U.S. Fish and Wildlife Service.

- ^a The detailed programmatic design features for each resource area to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in the proposed Brenda SEZ.
- ^b The scientific names of all plants, wildlife, aquatic biota, and special status species are provided in Sections 8.1.10 through 8.1.12.

1 applicable sections for detailed support of the impact assessment. Section 8.1.22 discusses
2 potential cumulative impacts from solar energy development in the proposed SEZ.
3

4 Only those design features specific to the proposed Brenda SEZ are included in
5 Sections 8.1.2 through 8.1.21 and in the summary table. The detailed programmatic design
6 features for each resource as required under BLM's Solar Energy Program are presented in
7 Appendix A, Section A.2.2. These programmatic design features would also be required for
8 development in this and other SEZs.
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1 **8.1.2 Lands and Realty**

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4 **8.1.2.1 Affected Environment**

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6 The proposed Brenda SEZ is a small SEZ, and while it is located adjacent to a large block
7 of public land, it is bordered on the north and east by a combination of state and private lands.
8 The overall character of the land in the SEZ area is rural and undeveloped. The town of Brenda
9 is located about 3 mi (5 km) southwest of the SEZ. A county road crosses through the western
10 portion of the SEZ in a north–south orientation and about 320 acres (1.3 km²) of the SEZ are
11 separated from the rest of the area by the road. There is land disturbance on the south and west of
12 the SEZ associated with road construction, power line construction, mining, and development of
13 the town site. U.S. 60 parallels the southern side of the SEZ within 0.5 mi (0.8 km) and could
14 provide good access to the site. There are scattered home sites and RV parks along U.S. 60.
15

16 In addition to the county road, there is a small portion of a ROW for a fiber optic line
17 paralleling the highway that overlaps the SEZ. It is likely the actual line is not within the SEZ
18 since the ROW was granted in 40-acre (0.2-km²) aliquot parts.
19

20 As of February 2010, there were no ROW applications for solar energy facility
21 development on the SEZ, but there are numerous applications on public lands near the area.
22

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24 **8.1.2.2 Impacts**

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27 ***8.1.2.2.1 Construction and Operations***

28
29 Full development of the proposed Brenda SEZ could disturb up to 3,102 acres (13 km²)
30 (Table 8.1.1.2-1). Development of the SEZ for utility-scale solar energy production would
31 establish a large industrial area that would exclude many existing and potential uses of the
32 land, perhaps in perpetuity. Since the SEZ is rural and undeveloped, utility-scale solar energy
33 development would be a new and dominant land use in the area. If the SEZ were developed,
34 there could be conflict with local residential and commercial landowners nearby because of the
35 dramatic change in the appearance of the area. It also is possible that state and private lands
36 located adjacent to the SEZ, with landowner agreement, would be developed in the same or
37 complementary manner as the public lands.
38

39 Existing ROW authorizations in the SEZ are prior existing rights, and facilities within the
40 ROWs would not be adversely affected by solar energy development. There is a technical issue
41 about whether the existing ROW holders would agree to amend their existing ROWs to allow
42 solar development to occur within portions of the existing ROWs, or if it would be necessary
43 to make minor adjustments to the proposed SEZ boundary to avoid these ROWs. Either way,
44 existing facilities within the ROWs would be protected. Should the proposed SEZ be identified
45 as an SEZ in the Record of Decision (ROD) for this PEIS, the BLM would still have discretion
46 to authorize additional ROWs in the area until solar energy development was authorized, and

1 then future ROWs would be subject to the rights granted for solar energy development. Because
2 the area currently has so few ROWs present, and there is a large amount of potentially available
3 BLM-administered land nearby, it is not anticipated that approval of solar energy development
4 within the SEZ would have a significant impact on public land available for future ROWs in the
5 area.
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8 ***8.1.2.2.2 Transmission Facilities and Other Off-Site Infrastructure*** 9

10 Delivery of energy produced in the SEZ would require establishing connection to the
11 regional grid. For analysis purposes, it is assumed that initial connection to the grid would be
12 made to an existing 161-kV transmission line that is located 19 mi (31 km) west of the SEZ.
13 Construction of a new line to connect to this line would result in the disturbance of about
14 575 acres (2.3 km²).
15

16 U.S. 60 is adjacent to the SEZ, and it is assumed that no new roads would be required to
17 access the site. Roads and transmission lines would be constructed within the SEZ as part of the
18 development of the area.
19
20

21 **8.1.2.3 SEZ-Specific Design Features and Design Feature Effectiveness** 22

23 Implementing the programmatic design features described in Appendix A, Section A.2.2,
24 as required under BLM's Solar Energy Program would provide adequate mitigation for lands and
25 realty activities.
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8.1.3 Specially Designated Areas and Lands with Wilderness Characteristics

8.1.3.1 Affected Environment

Eight specially designated areas occur within 25 mi (40 km) of the proposed Brenda SEZ that potentially could be affected by solar energy development within the SEZ. Most of these areas are more than 5 mi (8 km) from the SEZ. These include (see Figure 8.1.3.1-1) the following:

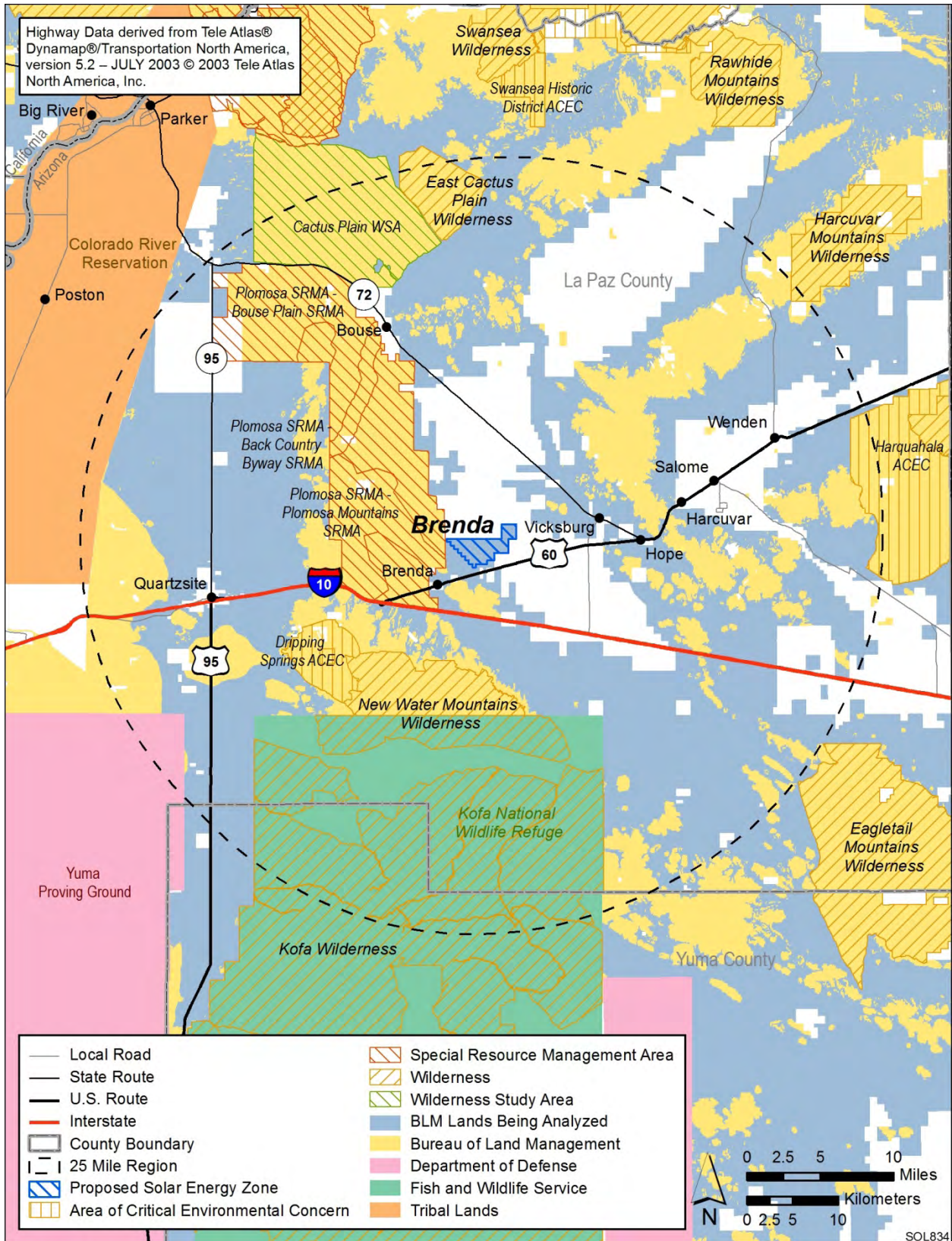
- Wilderness Areas (WAs)
 - East Cactus Plain
 - Kofa
 - New Water Mountains
- Wilderness Study Area (WSA)
 - Cactus Plain
- Areas of Critical Environmental Concern (ACECs)
 - Dripping Springs
 - Harquahala
- Special Recreation Management Area (SRMA)
 - Plomosa
- National Wildlife Refuge (NWR)
 - Kofa

There are no undesignated areas with wilderness characteristics near the SEZ. Viewshed analyses show that the Harquahala ACEC has such a small amount and percentage of the area within the viewshed that it is not considered further.

8.1.3.2 Impacts

8.1.3.2.1 Construction and Operations

The primary potential impact on the specially designated areas near the SEZ would be from visual impacts of solar energy development that could affect scenic and/or recreation resources, or wilderness characteristics of the areas. The visual impact could be associated with direct views of the solar facilities, including transmission facilities, glint and glare from reflective surfaces, steam plumes, hazard lighting of tall structures, and night lighting of the facilities. For wilderness areas and the WSA, visual impacts from solar development would be most likely to cause the loss of outstanding opportunities for solitude and primitive and unconfined recreation. While the visibility of solar facilities from specially designated areas is



2 **FIGURE 8.1.3.1-1 Specially Designated Areas in the Vicinity of the Proposed Brenda SEZ**

1 relatively easy to determine, the impact of this visibility is difficult to quantify and would vary
2 by solar technology employed, the specific area being affected, and the perception of individuals
3 viewing solar developments while recreating in areas within sight of the SEZ. Development of
4 the SEZ, especially full development, would be an important visual component in the viewshed
5 from portions of some of these specially designated areas as summarized in Table 8.1.3.2-1. The
6 data provided in the table, which shows the area with visibility of development within the SEZ,
7 assumes the use of power tower solar energy technology, 198.1 m (650 ft) tall. Of the
8 technologies being considered in the PEIS, these facilities (because of their potential height)
9 could be visible from the largest amount of land. Viewshed analysis for this SEZ has shown that
10 the visibility of shorter solar energy facilities would be less in some areas than power tower
11 technology. Section 8.3.14 provides detail on all viewshed analyses discussed in this section.
12 Potential impacts discussed below are general, and assessment of the visual impact of solar
13 energy projects must be conducted on a site-specific and technology-specific basis to accurately
14 identify impacts.

15
16 In general, the closer a viewer is to solar development, the greater the effect on an
17 individual's perception of impact. From a visual analysis perspective, the most sensitive viewing
18 distances generally are from 0 to 5 mi (0 to 8 km), but could be farther, depending on other
19 factors, such as the viewing height above or below a solar energy development area; the size of
20 the solar development area; and the purpose for which people visit an area. Individuals seeking a
21 wilderness or scenic experience within these specially designated areas could be expected to be
22 more adversely affected than those simply traveling along the highway with another destination
23 in mind. In the case of the Brenda SEZ, the flat terrain and the low-lying location of the SEZ in
24 relation to portions of some of the surrounding specially designated areas would highlight the
25 industrial-like development in the SEZ.

26
27 The occurrence of glint and glare at solar facilities could potentially cause large, though
28 temporary, increases in brightness and visibility of the facilities. The visual contrast levels
29 projected for sensitive visual resource areas that were used to assess potential impacts on
30 specially designated areas do not account for potential glint and glare effects; however, these
31 effects would be incorporated into a future site- and project-specific assessment that would be
32 conducted for specific proposed utility-scale solar energy projects.

33 34 35 **Wilderness Areas**

36
37
38 ***East Cactus Plain.*** The area is located about 20 mi (32 km) north of the SEZ, and a
39 large percentage of the area would have some view of the tops of any power tower facilities
40 in the SEZ. Based on the visual analysis, visibility of lower-level facilities would be almost
41 nonexistent. Because of the distance, intervening topography, and the extremely low viewing
42 angle of solar facilities, even with power tower facilities, there would be no impact on wilderness
43 characteristics within the WA.

TABLE 8.1.3.2-1 Potentially Affected Specially Designated Areas within a 25-mi (40-km) Viewshed of the Proposed Brenda SEZ^a

Feature Type	Feature Name (Total Acreage)	Feature Area or Linear Distance ^{b, c}		
		Visible within 5 mi	Visible between	
			5 and 15 mi	15 and 25 mi
WAs	East Cactus Plain (14,318 acres)	0 acres	0 acres	9,888 acres (69%)
	Kofa (547,739 acres)	0 acres	1,553 acres (0.3%)	5,019 acres (0.9%)
	New Water Mountains (24,628 acres)	0 acres	4,124 acres (17%)	0 acres
WSA	Cactus Plain (58,893 acres)	0 acres	0 acres	27,908 acres (47%)
NWR	Kofa (665,435 acres)	0 acres	7,122 acres (1%)	5,756 acres (0.9%)
SRMAs	Plomosa Backcountry Byway (5,987 acres)	0 acres	5,219 acres (87%)	152 acres (3%)
	Plomosa Bouse Plain (75,085 acres)	14,094 acres (19%)	22,272 acres (30%)	1,862 acres (3%)
	Plomosa Mountains (28,112 acres)	5,050 acres (18%)	5,085 acres (18%)	444 acres (2%)
ACECs	Dripping Springs (11,081 acres)	0 acres	420 acres (4%)	0 acres
	Harquahala (77,201 acres)	0 acres	0 acres	139 acres (0.2%)

^a Assuming power tower technology with a height of 650 ft (198.1 m).

^b To convert acres to km², multiply by 0.004047. To convert mi to km, multiply by 1.609.

^c Percentage of total feature acreage viewable.

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2
3

1 **Kofa.** The Kofa WA is located within the Kofa National Wildlife Refuge (NWR) and
2 at its closest is about 14 mi (23 km) south of the SEZ. The primary areas of the WA with a view
3 of the SEZ are the highest mountains in the central portion of the WA and the lower elevation
4 northeastern corner of the WA. The total area with visibility of the SEZ extends to about 24 mi
5 (39 km) south of the SEZ and includes 6,572 acres (27 km²), or 1.2%, of the total acreage of the
6 WA. Views from the high peaks would be restricted to the tops of power towers in the SEZ and
7 would be at a very low angle. Even at 14 mi (23 km), because of the lower elevations, views of
8 the SEZ would be at a low angle, and topographic screening from the Kofa, New Water, and
9 Bear Mountains would further restrict the views of the SEZ to a small portion of the field of
10 view. Because of these factors, the impact on wilderness characteristics is expected to be
11 minimal.
12
13

14 **New Water Mountains.** The New Water Mountains WA is located about 6.5 mi
15 (10.5 km) south of the SEZ, and portions of the area are substantially higher in elevation than the
16 SEZ. The areas with visibility of the SEZ are between 6.5 and 8.5 mi (10.5 and 13.7 km) from
17 the SEZ and would include about 4,124 acres (12 km²), or 17%, of the WA. The clearest view of
18 the SEZ is from portions of the WA in the northern end of the WA and from the areas of the
19 highest elevation. Because of the moderate contrast with the background, viewers in these areas
20 would be able to discern the structures in portions of the SEZ. The lower elevations of the WA
21 would have a lower angle view of facilities in the SEZ, which would minimize the contrast
22 between the structures and the surrounding landscape. Interstate 10 (I-10) and U.S. 60 are
23 between the New Water WA and the SEZ, and where they are visible from the WA, the overall
24 quality of the viewshed is already somewhat diminished. Because of the distances, the low
25 contrast of solar facilities from many areas, the relatively restricted opportunities to view the
26 SEZ, and the intervening highway development, the impact on wilderness characteristics from
27 solar development in the SEZ is anticipated to be low.
28
29

30 **Wilderness Study Area** 31 32

33 **Cactus Plain.** The Cactus Plain WA is 18 mi (29 km) northwest of the SEZ and is located
34 at a lower elevation than the SEZ. Viewshed analysis indicates that a maximum of 27,908 acres
35 (113 km²), or 47%, of the WSA would have a long distance view of solar facilities in the SEZ.
36 However, because of the distance and the very low angle of the view, no impact on wilderness
37 characteristics is anticipated.
38
39

40 **National Wildlife Refuge** 41 42

43 **Kofa.** The Kofa WA which is discussed above, makes up slightly more than 80% of the
44 total acreage of the Kofa NWR. Additional areas within the NWR with a view of the SEZ, that
45 are not designated as wilderness, include about 6,300 acres (25 km²) that are located from 11 to
46 16 mi (18 to 26 km) from the SEZ. While the primary use of the refuge is for the management of
47 bighorn sheep, recreational uses are also allowed; thus recreation users may utilize some of the

1 areas that have visibility of the SEZ. Because most of these areas are located at lower elevations
2 and are a long distance from the SEZ, they would have a very limited view of development
3 within the SEZ and the potential impact on the recreational experience in these areas would be
4 minimal. There would be no impact on wildlife resources within the refuge.
5
6

7 **Special Recreation Management Area**

8
9

10 **Plomosa.** The Plomosa SRMA is an area of about 110,000 acres (445 km²) that comes
11 within about one-eighth of a mile of the western boundary of the SEZ, at its nearest point. The
12 BLM has identified three management zones within the SRMA, the northernmost of which is a
13 BLM-designated Back Country Byway (BLM 2007a). The SRMA is located about 15 mi
14 (24 km) east of Quartzite, AZ, an area that attracts a large number of winter visitors who stay in
15 the area for up-to-six months. The SRMA is managed to provide a wide variety of outdoor
16 activities for local residents and visitors, including backcountry driving, cultural/historical
17 sightseeing, mountain biking, photography, hunting, hiking, camping, wildlife viewing, and
18 rockhounding. As shown in Table 8.1.3.2-1, a large percentage of all three management zones
19 are within 15 mi (24 km) and are within the viewshed of the SEZ. Impacts on visitors to the
20 SRMA from development of the SEZ are difficult to predict, but since most activities do not
21 require a pristine setting, impacts may be less than for visitors seeking a wilderness experience.
22

23 Solar development within the SEZ would be very visible from portions of the Bouse
24 Plain and Plomosa Mountains management zones in the SRMA within 5 mi (8 km), and it is
25 anticipated that there would be some adverse impact on the visual resources in those areas that
26 likely would result in some reduction on recreation use. A large part of the Backcountry Byway
27 management zone also is within the viewshed of the SEZ, but it is anticipated that because of the
28 9-mi (14.5-km) distance to the nearest boundary of the SEZ, there would be minimal impacts on
29 that zone.
30

31 **Areas of Critical Environmental Concern**

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33
34

35 **Dripping Springs and Dripping Springs Core.** The Dripping Springs area was
36 designated to protect a perennial spring that has important cultural resource values and also is
37 important to bighorn sheep. The area contains two separate ACECs, with the Dripping Springs
38 Core ACEC completely included within the other. The area is 9 mi (14 km) from the SEZ at its
39 nearest point to the SEZ. The visible area of the ACEC includes only the highest points within
40 the ACEC and extends approximately 12 mi (19.3 km) from the southern boundary of the SEZ.
41 About 420 acres (1.7 km²) would have visibility of facilities in the SEZ. Because of the distance
42 from the SEZ, the small amount of area with visibility of the SEZ, and the nature of the resources
43 being protected in the ACECs, it is anticipated that there would be no impact on the ACECs from
44 solar facilities in the SEZ.
45
46
47

1 **8.1.3.2.2 Transmission Facilities and Other Off-Site Infrastructure**
2

3 For analysis purposes, it is assumed that initial connection to the grid would be made to
4 an existing 161-kV transmission line that is located 19 mi (31 km) west of the SEZ. Construction
5 of a new line to connect to this line would result in the disturbance of about 575 acres (2.3 km²)
6 and would be visible from portions of the Plomosa SRMA, the New Water WA, and possibly the
7 Dripping Springs ACEC. It is assumed that the transmission line would be constructed in the
8 designated local and Section 368b (of the Energy Policy Act of 2005) corridors that follow
9 U.S. 60 and I-10. Because of the existing disturbances along this anticipated transmission route
10 and the distance from most of the specially designated areas, no additional impact caused by the
11 construction of transmission facilities to these areas is anticipated.
12
13

14 **8.1.3.3 SEZ-Specific Design Features and Design Feature Effectiveness**
15

16 Implementing the programmatic design features described in Appendix A, Section A.2.2,
17 as required under BLM’s Solar Energy Program would provide adequate mitigation for some
18 identified impacts. The exceptions may be impacts on visual resources and recreation use in
19 portions of the Plomosa SRMA.
20

21 Proposed design features specific to the proposed SEZ include:
22

- 23 • To reduce potential impacts on the Plomosa SRMA, consideration should be
24 given to restricting solar energy development in the SEZ to areas east of the
25 existing county road.
- 26 • If the SEZ were restricted to the use of lower profile solar energy facilities,
27 potential visual impacts would be reduced in the Plomosa SRMA, the Kofa
28 and New Water WAs, and the Dripping Springs ACEC.
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1 **8.1.4 Rangeland Resources**

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3 Rangeland resources include livestock grazing and wild horses and burros, both of
4 which are managed by the BLM. These resources and possible impacts on them from solar
5 development within the proposed Brenda SEZ are discussed in Sections 8.1.4.1 and 8.1.4.2.
6

7
8 **8.1.4.1 Livestock Grazing**

9
10
11 **8.1.4.1.1 Affected Environment**

12
13 The proposed Brenda SEZ is located within the 234,645-acre (950-km²) Crowder-
14 Weisser grazing allotment, which supports 15,758 AUMs. The public lands in the SEZ constitute
15 less than 2% of the total grazing allotment. One permittee operates in the allotment (BLM 2009).
16

17
18 **8.1.4.1.2 Impacts**

19
20
21 **Construction and Operations**

22
23 Should utility-scale solar development occur in the SEZ, grazing would be excluded from
24 the areas developed, as provided for in the BLM grazing regulations (43 CFR Part 4100). This
25 would include reimbursement of the permittee for the portion of the value for any range
26 improvements in the area removed from the grazing allotment. The impact of this change in the
27 grazing permit would depend on several factors, including (1) how much of an allotment the
28 permittee might lose to development, (2) how important the specific land lost is to the
29 permittee's overall operation, and (3) the amount of actual forage production that would be lost
30 by the permittee. The specific location of solar facilities within the allotment may disrupt
31 existing livestock improvements, such as wells, water pipelines, water developments, and fences
32 that support livestock management activities. The actual impact on these facilities cannot be
33 determined until a specific solar project has been proposed. Impact on these management
34 facilities is one of the items that would be considered when analyzing the three factors
35 mentioned above.
36

37 Using the simplified assumption that the percentage reduction in AUMs would be equal
38 to the percentage loss of the acreage in the allotment, there would be a potential loss of
39 315 AUMs from the grazing permit. However, since the Weisser-Crowder allotment is so large,
40 it is anticipated that it may be possible to absorb this potential loss elsewhere in the allotment
41 through either installation of additional range improvements or changes in grazing management.
42 Should it not be possible to mitigate the loss of AUMs, there would be a small impact to the
43 permittee.
44
45
46

1 **Transmission Facilities and Other Off-Site Infrastructure**

2
3 For analysis purposes, it is assumed that initial connection to the grid would be made to
4 an existing 161-kV transmission line that is located 19 mi (31 km) west of the SEZ. Construction
5 of a new line to connect to this existing line would result in a maximum disturbance of about
6 575 acres (2.3 km²) that would be completely within the Crowder-Weisser allotment. Using the
7 assumption that it requires approximately 15 acres to support one AUM¹, there could be a
8 maximum loss of an additional 38 AUMs associated with construction of the transmission line.
9

10
11 **8.1.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness**

12
13 Implementing the programmatic design features described in Appendix A, Section A.2.2,
14 as required under BLM’s Solar Energy Program would provide mitigation for some impacts on
15 livestock grazing. The exceptions may be in the potential loss of 353 AUMs for the Weisser-
16 Crowder grazing allotment.
17

18 The following is a proposed design feature specific to the proposed SEZ:

- 19
20 • Development of range improvements and changes in grazing management
21 should be considered to mitigate the loss of AUMs in the grazing allotment.
22
23

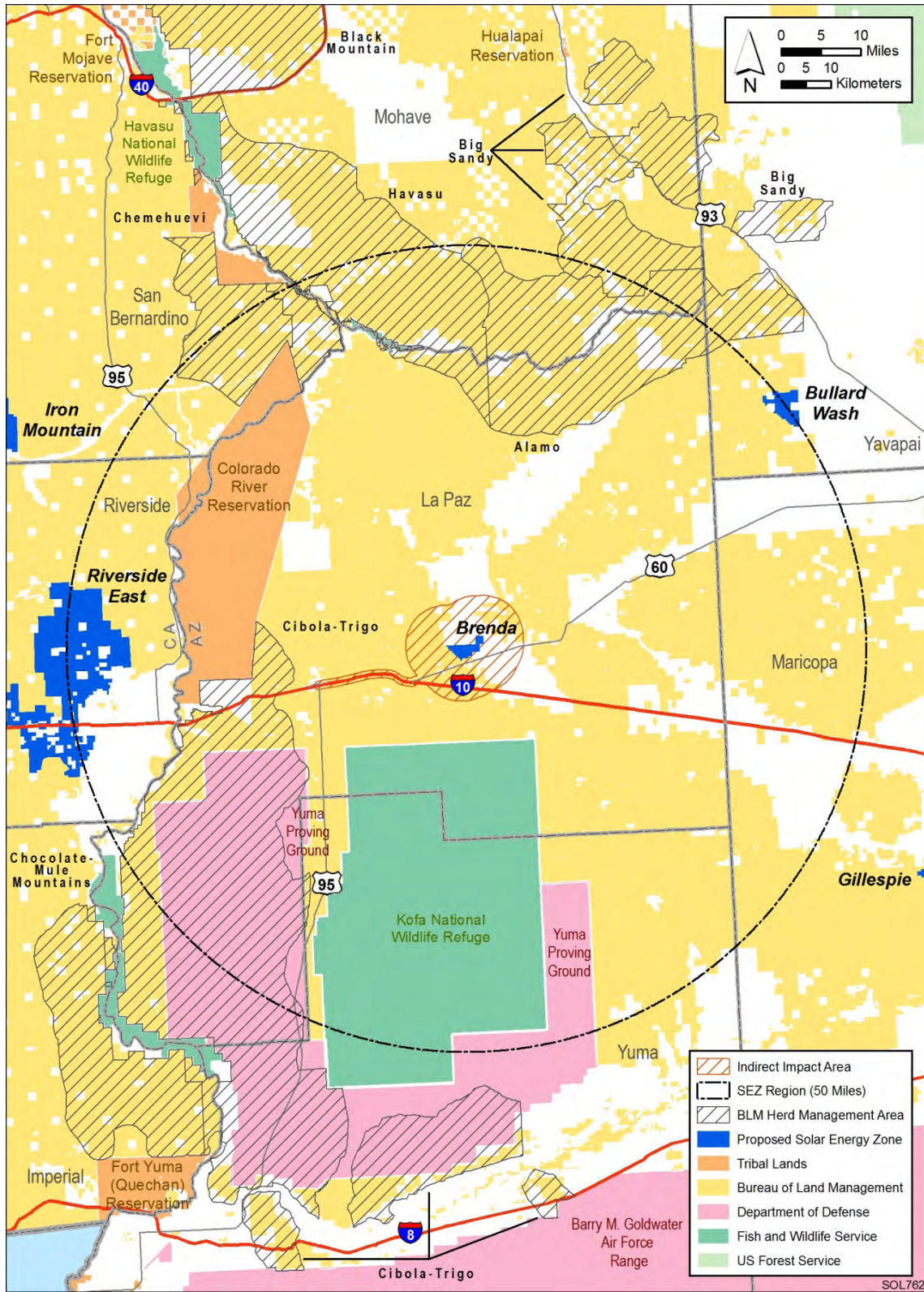
24 **8.1.4.2 Wild Horses and Burros**

25
26
27 **8.1.4.2.1 Affected Environment**

28
29 Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur
30 within the six-state study area. Seven wild horse and burro herd management areas (HMAs)
31 occur within Arizona (BLM 2010a); portions of four of them (Alamo, Big Sandy, Cibola-Trigo,
32 and Havasu) occur within the 50-mi (80-km) SEZ region for the proposed Brenda SEZ
33 (Figure 8.1.4.2-1). A portion of the Chemehuevi HMA, an HMA in California, also occurs
34 within the SEZ region. None of the HMAs occur within the SEZ or indirect impact area of
35 the SEZ.
36

37 In addition to the HMAs managed by the BLM, the U.S. Forest Service (USFS) has wild
38 horse and burro territories in Arizona, California, Nevada, New Mexico, and Utah and is the lead
39 management agency that administers 37 of the territories (Giffen 2009; USFS 2007). None of the
40 territories occur within the SEZ region.
41

¹ Based on a calculation comparing the total acreage of the allotment to the currently authorized AUMs.



1
 2 **FIGURE 8.1.4.2-1 Wild Horse and Burro Herd Management Areas within the Analysis**
 3 **Area for the Proposed Brenda SEZ (Source: BLM 2010a)**

1 **8.1.4.2.2 Impacts**
2

3 Because the proposed Brenda SEZ is about 19 mi (31 km) or more from any wild horse
4 and burro HMAs managed by the BLM and more than 50 mi (80 km) from any wild horse and
5 burro territory administered by the USFS, solar energy development within the SEZ would not
6 directly or indirectly affect wild horses and burros that are managed by these agencies.
7

8
9 **8.1.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness**
10

11 No SEZ-specific design features for solar development within the proposed Brenda SEZ
12 would be necessary to protect or minimize impacts on wild horses and burros.
13
14

1 **8.1.5 Recreation**

2
3
4 **8.1.5.1 Affected Environment**

5
6 The site of the proposed Brenda SEZ is located adjacent to U.S. 60 and is easily
7 accessible from many locations. The area is located within 3 mi (5 km) of Brenda, Arizona,
8 and is 15 mi (24 km) east of Quartzsite, Arizona, which is a hub of winter visitor activity in
9 southwestern Arizona and southeastern California. The area within the SEZ is flat and generally
10 unremarkable, with few passable roads and trails that provide access through the area. The area
11 is located adjacent to the Plomosa SRMA, which is briefly described above in Section 8.1.3.2.1.
12 A county road passes north–south through the western portion of the SEZ and provides a major
13 access point into the Plomosa SRMA. There is an access road to the SRMA that departs the
14 county road and passes through the portion of the proposed SEZ, west of the road. While there is
15 no recreation use data for the area, a field investigation revealed few vehicle tracks in the area
16 and no signs of camping or other recreational uses. The area is designated for off-highway
17 vehicle (OHV) travel as “limited to designated roads and trails” (BLM 2007a). There are
18 designated routes located in the Plomosa SRMA just west of the SEZ.
19

20
21 **8.1.5.2 Impacts**

22
23
24 ***8.1.5.2.1 Construction and Operations***

25
26 Recreational users would lose the use of any portions of the SEZ developed for solar
27 energy production, but it is anticipated this would be a minimal loss of recreational use. Access
28 through areas developed for solar power production could be closed or rerouted, although the
29 existing county road would continue to provide general north–south access. One access point to
30 the SRMA through the western portion of the SEZ could be closed. The Plomosa SRMA could
31 provide replacement recreation opportunities for anyone displaced from the SEZ.
32

33 Portions of the Plomosa SRMA are adjacent to the SEZ, and solar development within
34 the SEZ would be very visible from areas within the SRMA. Whether the presence of solar
35 development in the SEZ would affect recreational use of the SRMA is unknown, but large
36 portions of the areas are located within the most sensitive visual zone surrounding the proposed
37 SEZ. It is anticipated that some current and potential users of portions of the SRMA may choose
38 to relocate their activities farther away from solar energy facilities. Some visitors may also find
39 the solar facilities as an interesting attraction to their other activities.
40

41 Potential impacts to recreation use in portions of the New Water and Kofa WAs and the
42 Dripping Springs ACEC are difficult to assess, but it is possible that visitors seeking a wilderness
43 and/or scenic experience may avoid those areas with views of the SEZ.
44

45 Solar development within the SEZ would affect public access along OHV routes that are
46 designated open and available for public use. If such routes were identified during project-

1 specific analyses, they would be re-designated as closed. (See Section 5.5.1 for more details on
2 how routes coinciding with proposed solar facilities would be treated.)
3
4

5 **8.1.5.2.2 Transmission Facilities and Other Off-Site Infrastructure** 6

7 For analysis purposes, it is assumed that initial connection to the grid would be made to
8 an existing 161-kV transmission line that is located 19 mi (31 km) west of the SEZ. Construction
9 of a new line to connect to this line would result in the disturbance of about 575 acres (2.3 km²).
10 It is anticipated that there would not be any additional impact on recreational use by the
11 construction of transmission facilities.
12
13

14 **8.1.5.3 SEZ-Specific Design Features and Design Feature Effectiveness** 15

16 Implementing the programmatic design features described in Appendix A, Section A.2.2,
17 as required under BLM's Solar Energy Program, would provide mitigation for some impacts on
18 recreation. The exceptions would be that recreational use within the SEZ would be lost, and
19 some current and potential users of portions of the SRMA may choose to relocate their activities
20 farther away from solar energy facilities.
21

22 Proposed design features specific to the proposed SEZ include:
23

- 24 • To reduce potential impacts to recreation use in the Plomosa SRMA,
25 consideration should be given to restricting solar energy development in the
26 SEZ to areas east of the county road.
- 27 • If the SEZ were restricted to the use of lower-profile solar energy facilities,
28 impacts to recreation use in the SRMA would likely be reduced.
29
30
31
32

1 **8.1.6 Military and Civilian Aviation**

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3
4 **8.1.6.1 Affected Environment**

5
6 The SEZ is located within an extensive web of military training routes (MTRs), and the
7 entire SEZ is covered by a combination of three MTRs with 300-ft (91-m) above-ground-level
8 (AGL) operating limits. Two of these routes are used as visual flight rule (VFR) corridors, and
9 one is an instrument flight rule (IFR) corridor.

10
11 The closest civilian airports are located in Blythe, California, and Parker, Arizona.
12 The Blythe Airport is located west of the SEZ about 48 mi (77 km), and the Parker Airport
13 (Avi Suquilla Airport) is about 38 mi (61 km) northwest of the SEZ. Neither of these airports
14 has regularly scheduled passenger or freight service.

15
16
17 **8.1.6.2 Impacts**

18
19 The military has indicated that the construction of solar or transmission facilities in
20 excess of 250 ft (76 m) tall would adversely affect the use of the MTRs.

21
22 The Blythe and Parker airports are located far enough away from the proposed SEZ that
23 there would be no effect on airport operations.

24
25
26 **8.1.6.3 SEZ-Specific Design Features and Design Feature Effectiveness**

27
28 No SEZ-specific design features are required. The programmatic design features
29 described in Appendix A, Section A.2.2, would require early coordination with the DoD to
30 identify and mitigate, if possible, potential impacts on the use of MTRs.

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1 **8.1.7 Geologic Setting and Soil Resources**

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4 **8.1.7.1 Affected Environment**

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7 **8.1.7.1.1 Geologic Setting**

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9
10 **Regional Setting**

11
12 The proposed Brenda SEZ is located in the northern part of the Ranegras Plain, a
13 northwest-trending, broad, alluvial basin within the Basin and Range physiographic province in
14 west-central Arizona. The plain is bounded on the north by the Bouse Hills, on the west by the
15 Plomosa and New Water Mountains, on the east by the Granite Wash and Little Harquahala
16 Mountains, and on the south by the Eagletail and Little Horn Mountains (Figure 8.1.7.1-1).
17 Surrounded by low, block-faulted mountains, the Ranegras Plain is one of many structural
18 basins (grabens) typical of the Basin and Range province.

19
20 Basin-fill beneath the Ranegras Plain consists of unconsolidated alluvial, eolian, and
21 lacustrine deposits of Quaternary and Tertiary age estimated to be as thick as 1,000 ft (305 m) in
22 the center of the basin (Figure 8.1.7.1-2). Groundwater occurs in these deposits, with the highest
23 yields from the gravel and sand lenses within the upper (Quaternary) layers of fill at depths
24 ranging from 28 to 455 ft (9 to 140 m) (ADWR 2010h,i; Metzger 1951). Unconsolidated
25 sediments overlie bedrock units of Cretaceous and Tertiary conglomerates and volcanic rocks
26 with a maximum depth of about 2,000 ft (610 m). The basin is underlain by a basement complex
27 of granite and undifferentiated metamorphic rocks (Fugro National, Inc 1979).

28
29 Exposed sediments on the Ranegras Plain are predominantly young (<10,000 years)
30 alluvial deposits of gravel and sand (stream channels) and silt and clay (floodplains and playas)
31 and eolian sands (Qy) (Figure 8.1.7.1-3). The surface of the Brenda SEZ is covered mainly by
32 older (10,000 to 750,000 years) alluvial deposits (Qm). In the surrounding mountains, exposures
33 are predominantly composed of Tertiary volcanics and Cretaceous and Jurassic sedimentary
34 rocks. The oldest rocks in the region are the Early to Middle Proterozoic metamorphic and
35 granitic rocks that occur in the Plomosa Mountains and Bouse Hills northwest of the SEZ and the
36 Granite Wash Mountains to the northeast. These rocks have been intruded by Mesozoic (Late
37 Cretaceous to Tertiary) granites and granodiorites. Small outcrops of Paleozoic limestone occur
38 throughout the area.

39
40
41 **Topography**

42
43 The Ranegras Plain covers an area of about 538,700 acres (2,360 km²) (ADWR 2010i). It
44 slopes to the northwest, with elevations along its axis ranging from about 1,310 ft (400 m) at its
45 southeastern end and along its sides to about 930 ft (280 m) near the town of Bouse at its
46 northwestern end. Alluvial fan deposits occur along the mountain fronts on both sides of the

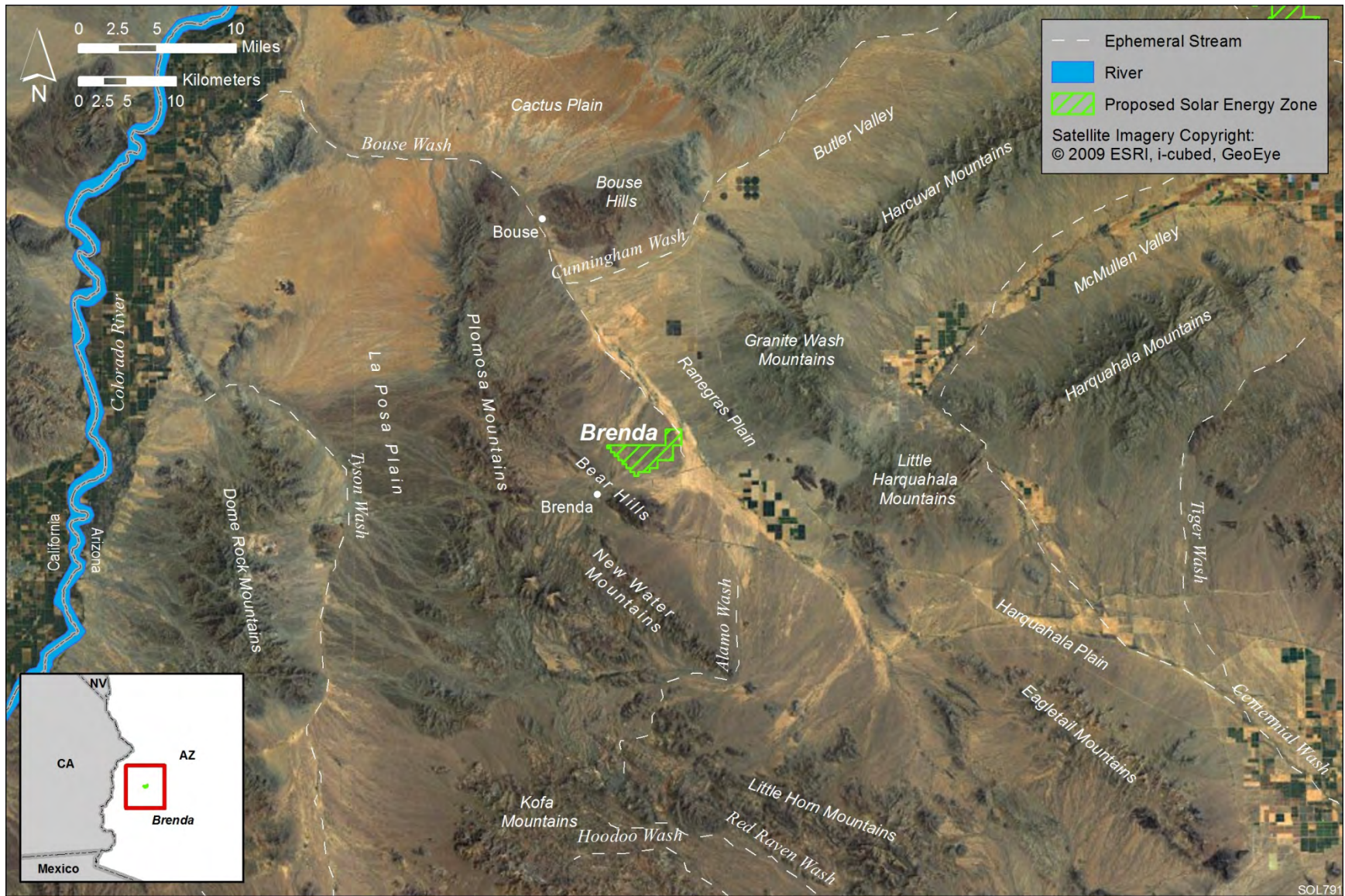
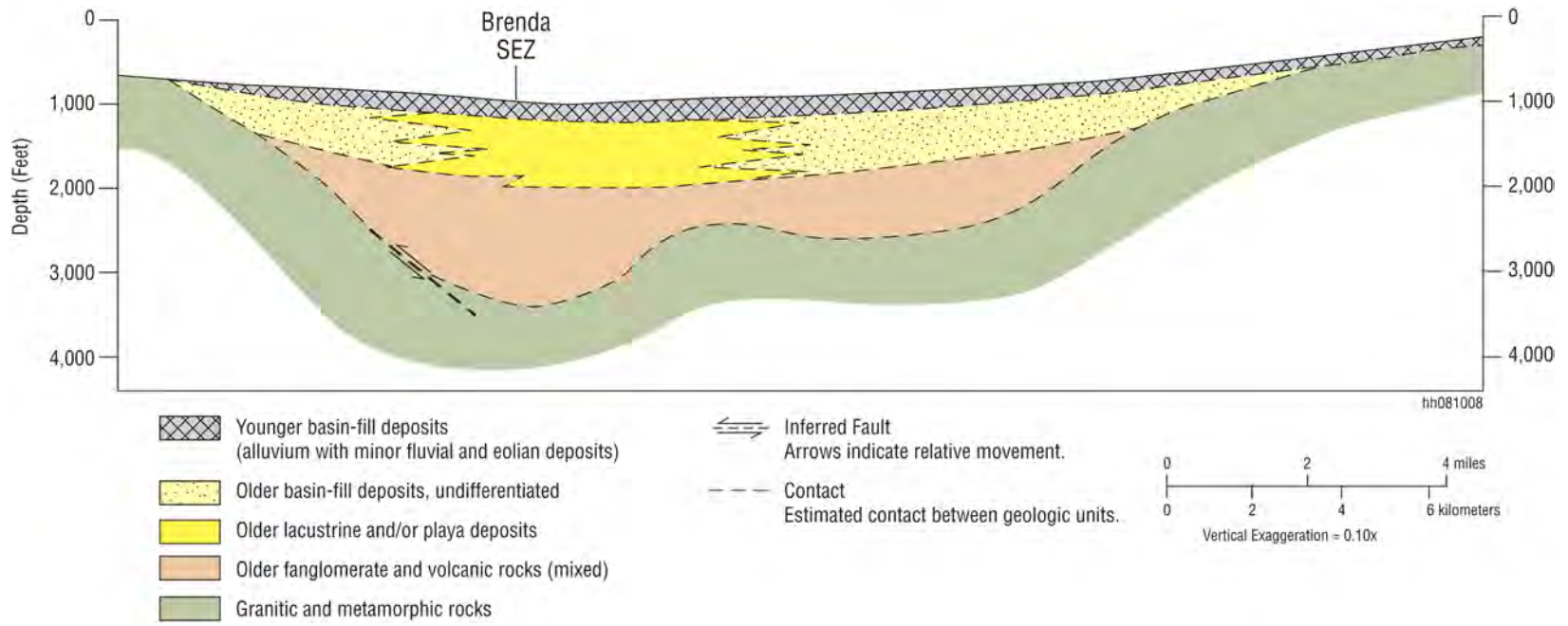


FIGURE 8.1.7.1-1 Physiographic Features of the Ranegras Plain



8.1-39
1

2 **FIGURE 8.1.7.1-2 Generalized Geologic Cross Section (southwest to northeast) across the Northwestern Part of the Ranegras**
3 **Plain (see Figure 8.1.7.1-5 for section location.) (Source: modified from Fugro National, Inc. 1979)**
4



1

2

FIGURE 8.1.7.1-3 Geologic Map of the Ranegras Plain Region (adapted from Ludington et al. 2007; Richard et al. 2000)

3

4

Cenozoic (Quaternary, Tertiary)

- Qy Young alluvium in stream channels and on flood plains and playas (0 to 10,000 yr)
- Q Surficial deposits, including wind-blown sand (0 to 2 m.y.)
- Qm Surficial deposits (10,000 to 750,000 yr)
- Qo Older surficial deposits (750,000 to 3 m.y.)
- Tsy Consolidated conglomerate and sandstone
- Tsv Volcanic and sedimentary rocks, undivided
- Tsm Sedimentary rocks
- Tv Volcanic rocks
- Tg Granitic rocks
- Ti Shallow intrusives
- TKgm Muscovite-bearing granitic rocks (associated with abundant pegmatite dikes)

Mesozoic

- KJs Sedimentary rocks with minor volcanic rocks
- Jg Granitic rocks
- Jv Volcanic rocks
- MzPz Metamorphosed sedimentary rocks (Jurassic to Cambrian)

Paleozoic

- Pz Sedimentary rocks (Kaibab and Toromeap Formations; Coconino sandstone)

Precambrian

- Yg Granitic rocks (1,400 to 1,450 m.y.)
- Xg Granitic rocks (1,600 to 1,800 m.y.)

1

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2 **FIGURE 8.1.7.1-3 (Cont.)**

1 valley. The valley is drained by Bouse Wash, an ephemeral stream that captures drainage from
2 Butler and McMullen Valleys and exits the basin near the town of Bouse. Bouse Wash is a
3 tributary to the Colorado River (to the west). Other topographic features include sand dunes,
4 playas, and the many unnamed washes that drain the surrounding mountains and feed the central
5 streams in the valley center.
6

7 The proposed Brenda SEZ is located in the northwestern end of the Ranegras Plain, in La
8 Paz County, between the Bear Hills to the southwest and the Granite Wash Mountains to the
9 northeast (Figure 8.1.7.1-1). Its terrain slopes gently to the northeast, with elevations ranging
10 from about 1,240 ft (380 m) along its southwestern border to 1,110 ft (340 m) at the northeastern
11 corner (Figure 8.1.7.1-4). Several drainages enter the SEZ from the southwest; Bouse Wash
12 drains to the northwest, just beyond the northeast corner of the site.
13

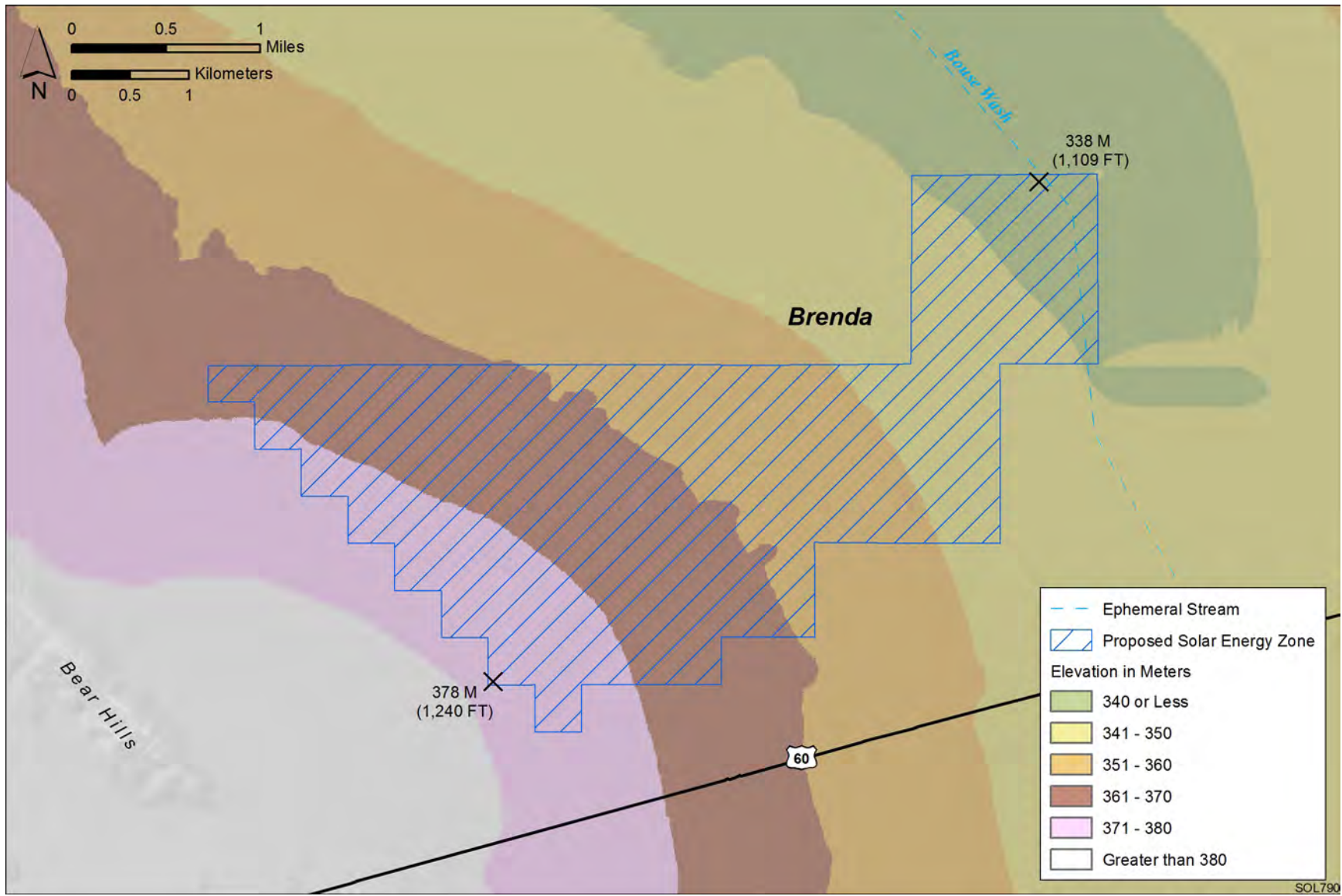
14 **Geologic Hazards**

15
16
17 The types of geologic hazards that could potentially affect solar project sites and their
18 mitigation are discussed in Sections 5.7.3 and 5.7.4. The following sections provide a
19 preliminary assessment of these hazards at the proposed Brenda SEZ. Solar project developers
20 may need to conduct a geotechnical investigation to assess geologic hazards locally to better
21 identify facility design criteria and site-specific design features to minimize their risk.
22
23

24 **Seismicity.** Most of the seismic activity in Arizona occurs along the northwest-trending
25 boundary (transition zone) between the Basin and Range and Colorado Plateau physiographic
26 provinces to the north of the three proposed Arizona SEZs (Figure 8.1.7.1-5). No Quaternary
27 faults have been identified within the Ranegras Plain (USGS and AGS 2010); however, older
28 faults of Cretaceous and Tertiary age, now covered by thick alluvium, have been inferred from
29 topographic features (Metzger 1951).
30

31 From June 1, 2000, to May 31, 2010, there were no earthquakes recorded within a 61-mi
32 (100-km) radius of the proposed Brenda SEZ (USGS 2010c). The most recent earthquakes have
33 occurred in northern Arizona (north of Flagstaff) and in southeastern California (DuBois and
34 Smith 1980). The largest earthquake in the region occurred on February 4, 1976, near Prescott,
35 Arizona, about 100 mi (160 km) northeast of the Brenda SEZ (Figure 8.1.7.1-5). The earthquake
36 registered a magnitude (ML^2) of 5.2 (USGS 2010c).
37
38
39
40

² Richter scale magnitude (ML) was the original magnitude defined by Richter and Gutenberg for local earthquakes in 1935. It was based on the maximum amplitude recorded on a Wood-Anderson torsion seismograph but is currently calculated for earthquakes with magnitudes ranging from 2 to 6, using modern instruments with adjustments (USGS 2010e).



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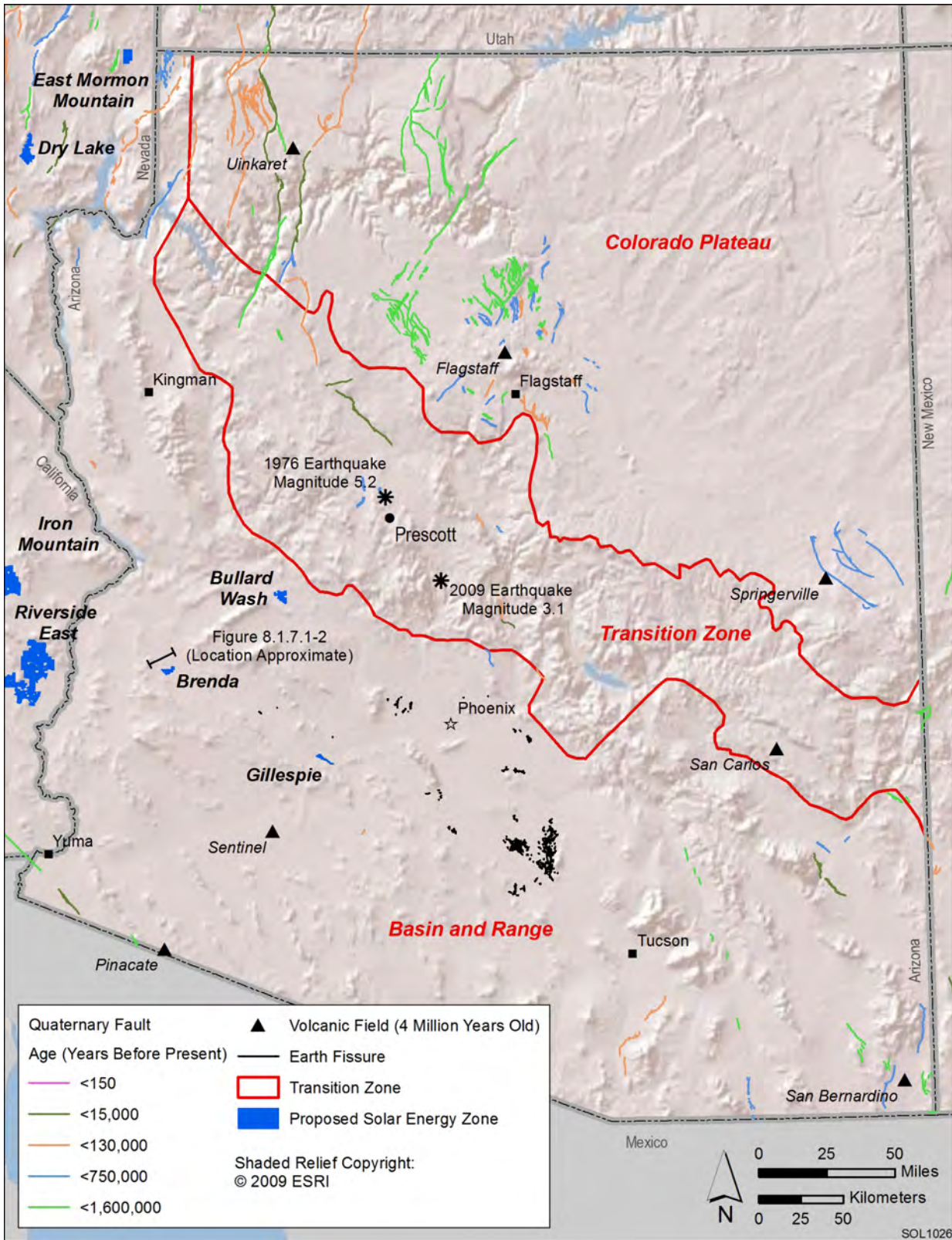
FIGURE 8.1.7.1-4 General Terrain of the Proposed Brenda SEZ

1 **Liquefaction.** The proposed Brenda SEZ lies within an area where the peak horizontal
2 acceleration with a 10% probability of exceedance in 50 years is between 0.03 and 0.04 g.
3 Shaking associated with this level of acceleration is generally perceived as light to moderate; the
4 potential damage to structures is very light (USGS 2008). Given the absence of earthquakes
5 within a 61-mi (100-km) radius of the Brenda SEZ and the very low intensity of ground shaking
6 estimated for the area, the potential for liquefaction in valley sediments is also likely to be very
7 low.
8
9

10 **Volcanic Hazards.** Extensive volcanic activity occurred in Arizona throughout the
11 Tertiary period; the most recent activity occurred less than 4 million years ago, mainly along the
12 edge of the Colorado Plateau in northeastern Arizona (Figure 8.1.7.1-5). Over the past 15 million
13 years, eruptions were predominantly composed of basalt. The nearest volcanic center is the
14 Sentinel volcanic field, about 70 mi (116 km) to the southeast of the proposed Brenda SEZ;
15 basaltic lava flows erupted from volcanic vents in this area from about 3.3 million to 1.3 million
16 years ago (Wood and Kienle 1992). Quaternary basalt outcrops have also been observed in
17 Bouse Hills and the Plomosa Mountains (Metzger 1951). There is currently no evidence of
18 volcanic activity in Arizona (Fellows 2000). Lynch (1982) suggests that the next eruption in
19 Arizona would be most likely to occur in the San Francisco Mountain, Uinkaret, or Pinacate
20 volcanic fields and, because it would likely be of the strombolian type (basaltic lava from a
21 single vent with intermittent explosions), would cause little damage or disruption.
22
23

24 **Slope Stability and Land Subsidence.** The incidence of rock falls and slope failures can
25 be moderate to high along mountain fronts and can present a hazard to facilities on the relatively
26 flat terrain of valley floors such as the Ranegras Plain, if they are located at the base of steep
27 slopes. The risk of rock falls and slope failures decreases toward the flat valley center.
28

29 The Arizona Geological Survey has reviewed aerial and satellite imagery and conducted
30 on-the-ground investigations at 23 study areas to identify and map earth fissures with surface
31 expression. The study areas are within four Arizona counties (Pinal, Maricopa, Cochise, and
32 Pima) that are prone to fissuring (Shipman and Diaz 2008). To date, earth fissures and
33 subsidence of about 0.6 ft (0.2 m) have been identified within the Harquahala Plain on the east
34 side of the Eagletail Mountains (Maricopa County), about 40 mi (64 km) east-southeast of the
35 proposed Brenda SEZ (AGS 2010; Galloway et al. 1999) (Figure 8.1.7.1-5). The fissures are the
36 result of ground subsidence resulting from groundwater overdrafts in the basin that have caused
37 differential compaction in the underlying aquifer. Land failure caused by subsidence and fissures
38 in parts of Arizona has been significant enough to damage buildings, roads, railroads, and sewer
39 lines, and to necessitate changes in the planned route of the Central Arizona Project (CAP)
40 aqueduct (Galloway et al. 1999). Subsidence on the Ranegras Plain is also likely because of
41 marked declines in groundwater levels since the 1950s (reported by the ADWR [2010i]) as a
42 result of the high rates of irrigation pumpage in the basin.
43



1
2 **FIGURE 8.1.7.1-5 Quaternary Faults, Volcanic Fields, and Earth Fissures in Arizona (Sources:**
3 **USGS and AGS 2010; USGS 2010c)**

1 **Other Hazards.** Other potential hazards at the proposed Brenda SEZ include those
2 associated with soil compaction (restricted infiltration and increased runoff), expanding clay
3 soils (destabilization of structures), and hydro-compactable or collapsible soil (settlement).
4 Disturbance of soil crusts and desert pavement on soil surfaces may increase the likelihood of
5 soil erosion by wind.
6

7 Alluvial fan surfaces, such as those found along the Ranegras Plain, can be the sites of
8 damaging high-velocity “flash” floods and debris flows during periods of intense and prolonged
9 rainfall. The nature of the flooding and sedimentation processes (e.g., stream flow versus debris
10 flow fans) will depend on the specific morphology of the fan (National Research Council 1996).
11 Section 8.1.9.1.1 provides further discussion of flood risks within the Brenda SEZ.
12

13 **8.1.7.1.2 Soil Resources**

14 Most of the map unit composition within the proposed Brenda SEZ has not been
15 delineated. Soils are predominantly the loams and sandy loams of soil series Pahaka-Estrella-
16 Antho. The soils of these series are derived from mixed alluvium and are typical of alluvial fan
17 terraces and relict basin floors. With slopes ranging from 0 to 5%, the soils are characterized as
18 very deep and well to excessively well drained, with low to medium surface runoff (depending
19 on slope and landform), and moderate to moderately rapid permeability (NRCS 2010a). Because
20 of their fine-grained texture, they are moderately susceptible to wind erosion. Soils along the
21 southwestern-facing site boundary occupy slopes at the base of the Bear Hills and belong to the
22 Hyder-Coolidge-Ciprian-Cherioni soil series. These soils sit on bedrock and are shallower than
23 soils in other parts of the SEZ; surface runoff rates are also higher for these soils.
24
25

26 Soil map units for mapped soils within the Brenda SEZ (covering about 32%) are
27 described in Table 8.1.7.1-1. These are predominantly the sandy loams and gravelly sandy loams
28 of the Denure-Pahaka-Growler and Gunsight family-Rillito complexes, which together make up
29 about 18% of the soil coverage at the site (Figure 8.1.7.1-6). Parent material consists of fan
30 alluvium from mixed sources. Soils are characterized as deep and well drained with a low runoff
31 potential and moderate to moderately rapid permeability. The water erosion potential is slight to
32 moderate for all soils. The susceptibility to wind erosion is moderate, with as much as 86 tons
33 (78 metric tons) of soil eroded by wind per acre each year (NRCS 2010b).
34
35

36 Occasional flooding of the Gadsden-Glenbar complex soils occurs along the northeast
37 corner of the SEZ (on the Bouse Wash floodplain), with a 5 to 50% chance in any given year.
38 The flooding probability decreases away from Bouse Wash, with rare flooding (1 to 5% chance
39 in any given year) occurring on most other soils. The Gunsight family complexes occur on
40 higher ground, where the frequency of flooding is less than once in 500 years. Most of the soils
41 are not suitable for cultivation unless irrigated; none are classified as prime farmland. The major
42 crops in the region are alfalfa (hay and forage), cotton, and small grains (USDA 2010b;
43 NRCS 2010b).

TABLE 8.1.7.1-1 Summary of Soil Map Units within the Proposed Brenda SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential ^a	Wind Erosion Potential	Description	Area in Acres ^b (% of SEZ)
NOTCOM	Area not mapped	Not rated	Not rated	Map units not available. Soils belong to the following Soil Series: Pahaka-Estraella-Antho; Pahaka-Mohall-Laveen-Denure; and Hyder-Coolidge-Cipriano-Cherioni.	2,635 (68)
205	Denure-Pahaka-Growler complex (0 to 3% slopes)	Slight	Moderate (WEG 3) ^c	Consists of 30% Denure sandy loam, 30% Pahaka fine sandy loam, and 25% Growler fine sandy loam. Level to nearly level soils on alluvial fans. Parent material is fan alluvium from mixed sources. Soils are very deep and well drained, with low surface runoff potential (high infiltration rate) depending on slope and moderate to moderately rapid permeability. Available water capacity is low to moderate. Soil has features favorable to dust formation; high compaction potential. Used for rangeland, wildlife habitat, and irrigated cropland.	411 (11)
330	Gunsight family-Rillito complex (1 to 10% slopes)	Moderate	Moderate (WEG 5)	Consists of 55% Gunsight gravelly sandy loam and 35% Rillito gravelly sandy loam. Nearly level to gently sloping soils on alluvial fan terraces. Parent material is fan alluvium from mixed sources. Soils are very deep and somewhat excessively drained, with low surface runoff potential (high infiltration rate) and moderate permeability. Available water capacity is very low to low. Resists compaction. Used for rangeland, wildlife habitat, and irrigated cropland.	259 (7)

TABLE 8.1.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential ^a	Wind Erosion Potential	Description	Area in Acres ^b (% of SEZ)
200	Gunsight family-Pinamt complex (1 to 15% slopes)	Moderate	Moderate (WEG 6) ^c	Consists of 50% Gunsight very gravelly loam and 40% Pinamt extremely gravelly loam. Nearly level to gently sloping soils on alluvial fan terraces. Parent material is fan alluvium from mixed sources. Soils are very deep and well drained, with low surface runoff potential (high infiltration rate) and moderate to high permeability. Available water capacity is very low. High compaction potential. Used mainly for livestock grazing and wildlife habitat; unsuitable for cultivation.	159 (4)
312	Gadsden-Glenbar complex (0 to 2% slopes)	Moderate	Moderate (WEG 4)	Consists of 60% Gadsden silty clay loam and 35% Glenbar silty clay loam. Level to nearly level soils on flood plains. Parent material is mixed stream alluvium. Soils are very deep and well drained, with high surface runoff potential (very slow infiltration rate) and low permeability. Available water capacity is moderate. Soil has features favorable to dust formation; high compaction potential. Used for rangeland, wildlife habitat, and irrigated cropland.	149 (4)

^a Water erosion potential rates the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K (whole soil; doesn't account for the presence of rock fragments) and represent soil loss caused by sheet or rill erosion where 50 to 75 percent of the surface has been exposed by ground disturbance. A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions. A rating of "severe" indicates that erosion is expected; loss of soil productivity and damage are likely and erosion control measures may be costly or impractical.

^b To convert acres to km², multiply by 0.004047.

^c WEG=wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and also take into account soil moisture, surface cover, soil surface roughness, wind velocity and direction, and the length of unsheltered distance (USDA 2004). Groups range in value from 1 (most susceptible to wind erosion) to 8 (least susceptible to wind erosion). The NRCS provides a wind erodibility index, expressed as an erosion rate in tons per acre per year, for each of the wind erodibility groups: WEGs 3 and 4, 86 tons per acre per year; WEG 5, 56 tons per acre per year; and WEG 6, 48 tons per acre per year.

Source: NRCS (2010b).

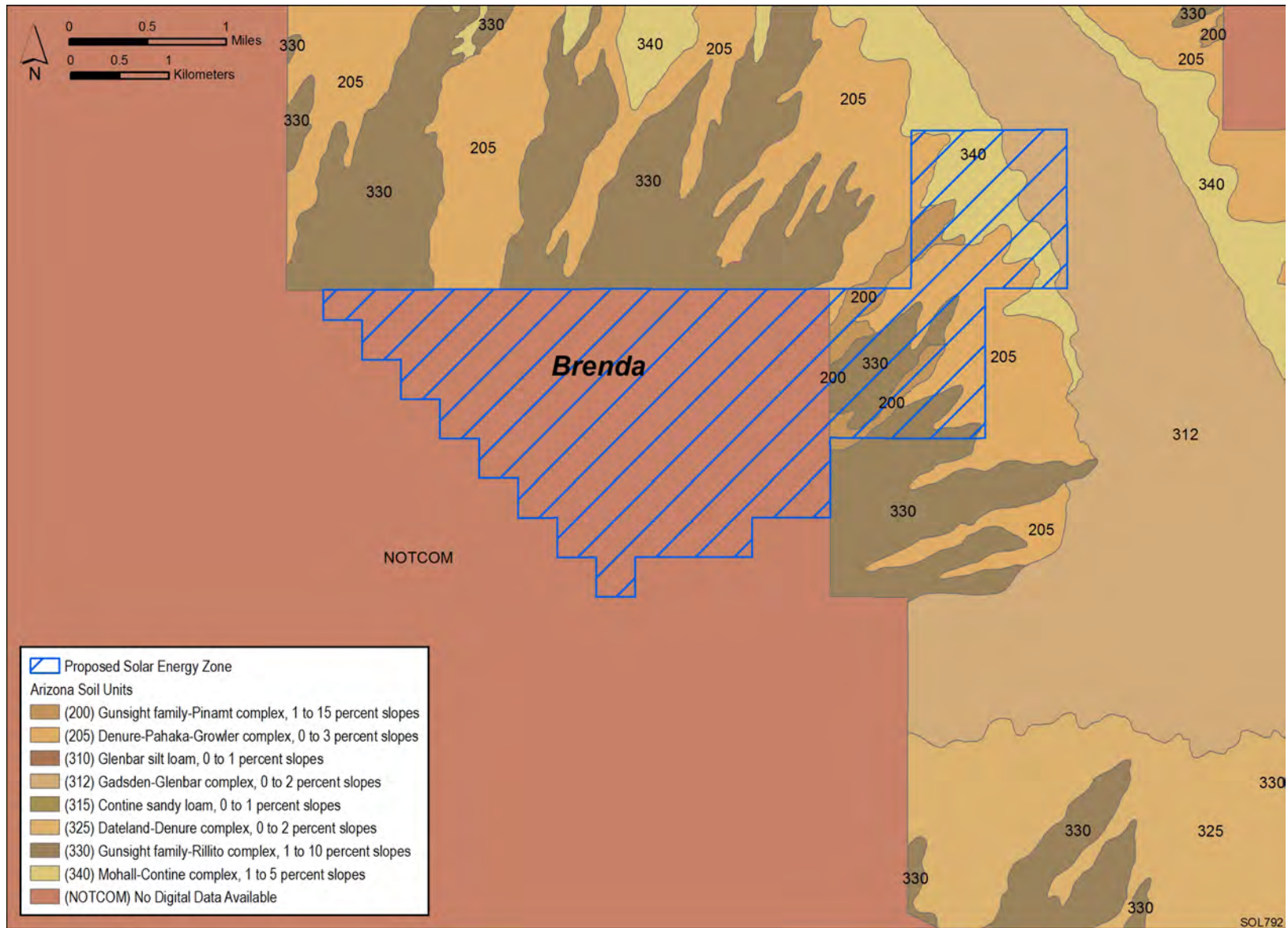


FIGURE 8.1.7.1-6 Soil Map for the Proposed Brenda SEZ (Source: NRCS 2008)

1 **8.1.7.2 Impacts**
2

3 Impacts on soil resources would occur mainly as a result of ground-disturbing activities
4 (e.g., grading, excavating, and drilling), especially during the construction phase of a solar
5 project. These impacts include soil compaction, soil horizon mixing, soil erosion and deposition
6 by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. Such
7 impacts are common to all utility-scale solar energy developments in varying degrees and are
8 described in more detail for the four phases of development in Section 5.7 .1.
9

10 Because impacts on soil resources result from ground-disturbing activities in the project
11 area, soil impacts would be roughly proportional to the size of a given solar facility, with larger
12 areas of disturbed soil having a greater potential for impacts than smaller areas (Section 5.7.2).
13 The magnitude of impacts would also depend on the types of components built for a given
14 facility since some components would involve greater disturbance and would take place over a
15 longer timeframe.
16

17 **8.1.7.3 SEZ-Specific Design Features and Design Feature Effectiveness**
18

19 No SEZ-specific design features were identified for soil resources at the proposed Brenda
20 SEZ. Implementing the programmatic design features described under both Soils and Air Quality
21 in Appendix A, Section A.2.2., as required under BLM’s Solar Energy Program would reduce
22 the potential for soil impacts during all project phases.
23
24

1 **8.1.8 Minerals (Fluids, Solids, and Geothermal Resources)**
2
3

4 **8.1.8.1 Affected Environment**
5

6 As of July 22, 2010, there were no locatable mining claims within the SEZ (BLM and
7 USFS 2010a), and the public land within the SEZ was closed to mineral entry in June 2009,
8 pending the outcome of this solar energy PEIS. There are no active oil and gas leases in the area,
9 and the area within the SEZ has not been leased in the past. There are public land parcels near
10 the SEZ that have been previously leased, but the leases have expired (BLM and USFS 2010b).
11 The area remains open for discretionary mineral leasing for oil and gas and other leasable
12 minerals, and for disposal of salable minerals. There is no active geothermal leasing or
13 development in or near the SEZ, nor has the area been leased previously (BLM and
14 USFS 2010b).
15

16
17 **8.1.8.2 Impacts**
18

19 If the area is identified as a solar energy zone, it would continue to be closed to all
20 incompatible forms of mineral development. For the purpose of this analysis, it is assumed
21 that future development of oil and gas resources, should any be found, would continue to be
22 possible, since such development could occur with directional drilling from outside the SEZ.
23 Since the SEZ does not contain existing mining claims, it was also assumed that there would be
24 no future loss of locatable mineral production. The production of common minerals, such as
25 sand and gravel, and mineral materials used for road construction or other purposes, might take
26 place in areas not directly developed for solar energy production.
27

28 Neither the SEZ nor areas surrounding it have had a history of leasing or development of
29 geothermal resources. For that reason, it is not anticipated that solar development would
30 adversely affect development of geothermal resources.
31

32
33 **8.1.8.3 SEZ-Specific Design Features and Design Feature Effectiveness**
34

35 No SEZ-specific design features were identified. Implementing the programmatic design
36 features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy
37 Program would provide adequate mitigation for impacts to mineral resources.
38
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1 **8.1.9 Water Resources**

2
3
4 **8.1.9.1 Affected Environment**

5
6 The proposed Brenda SEZ is located within the Colorado River Basin subregion of the
7 Lower Colorado Hydrologic Region (USGS 2010a) and the Basin and Range physiographic
8 province characterized by intermittent mountain ranges and desert valleys (Robson and Banta
9 1995). The proposed Brenda SEZ has surface elevations ranging between 1,110 and 1,235 ft
10 (338 and 376 m). The Brenda SEZ is located on the Ranegras Plain in the valley between the
11 Plomosa Mountains and the Bear Hills to the west–southwest and the Granite Wash Mountains
12 and Little Harquahala Mountains to the east (Figure 8.1.9.1-1). Annual precipitation is between
13 4 and 8 in./yr (10 to 20 cm/yr) in the valley and between 8 and 14 in./yr (20 and 36 cm/yr) in the
14 surrounding mountains (ADWR 2010a). Evaporation is estimated to be 115 in./yr (292 cm/yr)
15 (Cowherd et al. 1988).

16
17
18 **8.1.9.1.1 Surface Waters (Including Drainages, Floodplains, and Wetlands)**

19
20 There are no perennial surface water features in or near the proposed Brenda SEZ. The
21 Brenda SEZ is located within the Bouse Wash Basin, and Bouse Wash flows through the
22 northeastern part of the SEZ (Figure 8.1.9.1-1). Bouse Wash is an ephemeral stream that flows
23 from south to north along the centerline of the Ranegras Plain. Other named ephemeral washes
24 are the Alamo Wash, which flows from the Plomosa Mountains west of the proposed Brenda
25 SEZ to the Bouse Wash south of the Brenda SE, and the Cunningham Wash, which flows into
26 the Bouse Wash north of the Brenda SEZ. Several unnamed ephemeral washes flow out of the
27 Bear Hills to the southwest of the Brenda SEZ, creating an alluvial fan that covers the majority
28 of the SEZ. The Colorado River is the nearest perennial stream, and it is located about 32 mi (51
29 km) west of the Brenda SEZ. The Bouse Wash flows toward the Colorado River, but the channel
30 loses definition when it reaches the floodplain of the Colorado River in Parker Valley, which is
31 used for agriculture and is the site of the Colorado River Indian Reservation.

32
33 Flood hazards have not been identified (Zone D) for the region surrounding the proposed
34 Brenda SEZ (FEMA 2009). Intermittent flooding may occur with temporary ponding and erosion
35 along the Bouse Wash and along the ephemeral washes that originate in the adjacent Bear Hills.
36 No wetlands have been identified in the basin (USFWS 2009a).

37
38
39 **8.1.9.1.2 Groundwater**

40
41 The proposed Brenda SEZ is located within the Ranegras Plain groundwater basin.
42 Groundwater in the Ranegras Plain Basin occurs primarily in basin-fill deposits. Groundwater
43 flows through the basin from the southeast to the northwest and exits the basin near Bouse.
44 Water levels are shallowest in the northwestern parts of the basin near Bouse and deepest in the
45 eastern parts of the basin along the mountain fronts. Groundwater surface elevations range from
46 1,350 to 1,438 ft (411 to 438 m) in the southern portion of the basin and from 925 to 955 ft

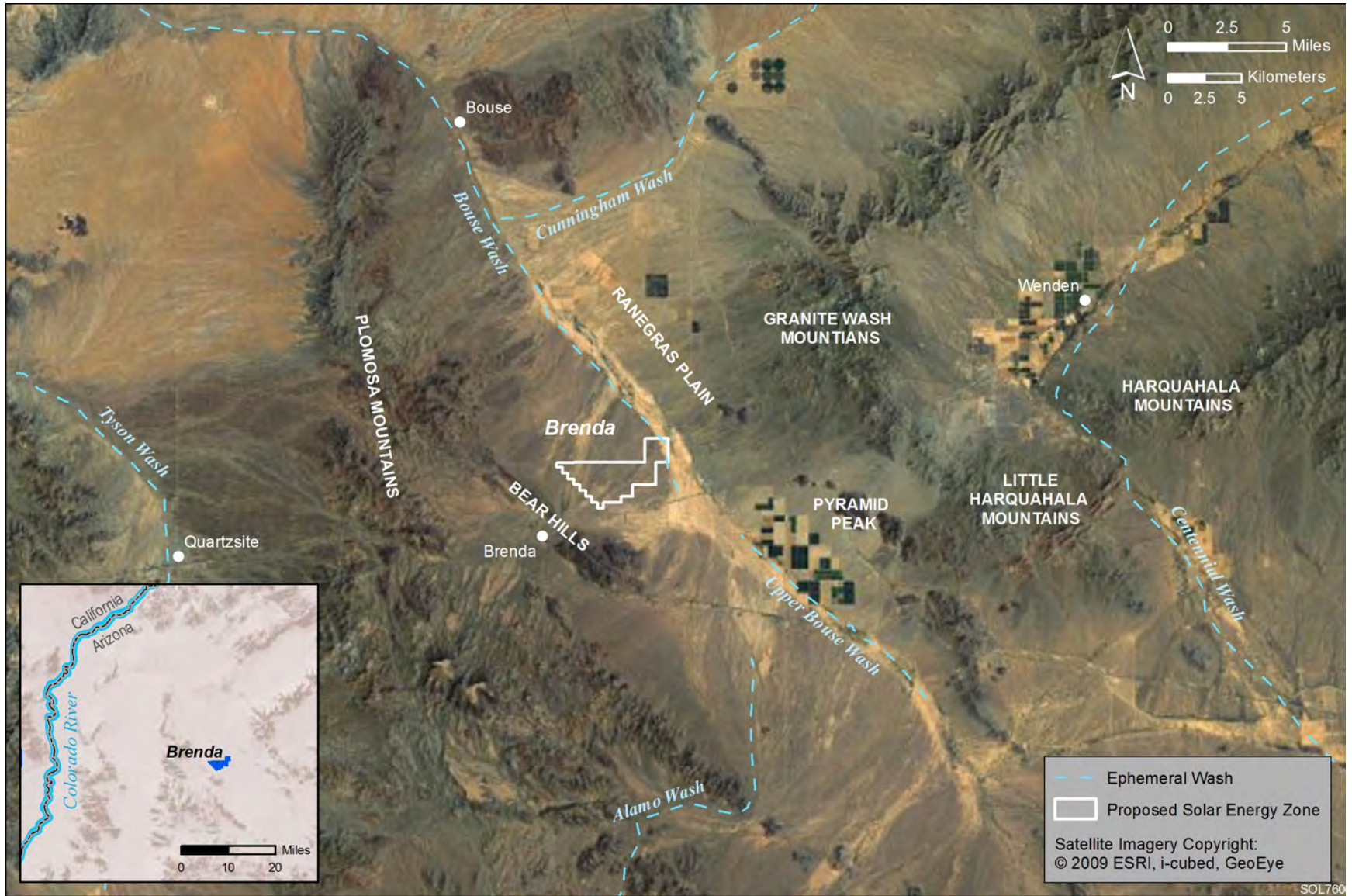


FIGURE 8.1.9.1-1 Surface Water Features near the Proposed Brenda SEZ

1 (282 to 291 m) in the northern portion of the basin (USGS 2010b; well numbers
2 335622114005601, 335555114000901, 333121113413001, and 332848113425101). Depth to
3 water measurements ranged from 158 to 239 ft (48 to 73 m) below ground surface within the
4 SEZ between 1993 and 2006 (USGS 2010b; well numbers 334422113524001,
5 334219113545001). In the Ranegras Plain Basin, water levels vary from 438 ft (134 m) below
6 ground surface at the southern end of the basin to 75 ft (23 m) below ground surface in the
7 northern part of the basin, near Bouse (ADWR 2010a). Water levels within the SEZ have
8 declined at an average rate of 0.34 to 4.6 in./yr (0.85 to 11.5 cm/yr) between 1948 and 2006
9 (USGS 2010b; well numbers 334422113524001, 334219113545001, and 334144113510601).

10
11 The Arizona Department of Water Resources (ADWR) has estimated that there are
12 21.7 million ac-ft (26.8 billion m³) of water available to a depth of 1,200 ft (366 m) below land
13 surface (ADWR 2010b). There are five estimates of natural recharge to the basin that range
14 from less than 1,000 ac-ft/yr (1.2 million m³/yr) to more than 6,000 ac-ft/yr (7.4 million m³/yr),
15 with the most recent estimates at about 5,000 ac-ft/yr (6.2 million m³/yr) (ADWR 2010a). Most
16 water is recharged into the aquifer by infiltration of runoff in Bouse Wash and its tributaries and
17 other runoff from the mountains at the basin margins. Recharge from precipitation is expected to
18 be small because of low precipitation and high evaporation rates. Through seepage, an additional
19 2,000 to 3,000 ac-ft (2.5 million to 3.7 million m³) of water could be recharged into the Ranegras
20 Plain basin annually from the Central Arizona Project Canal (ADWR 2010b). Inflow on the
21 order of less than 500 ac-ft/yr (620,000 m³/yr) may also occur from each of two adjacent
22 groundwater basins: Butler Valley and the Haquahala Basin. An estimated outflow of less than
23 1,000 ac-ft/yr (1.2 million m³/yr) from the Parker Basin occurs near the town of Bouse (Freethy
24 and Anderson 1986).

25
26 Specific capacity of wells in the basin has been estimated to range from 3 to 57 gallons
27 per minute (11 to 216 L/min) per foot of aquifer drawdown, with lower values in the northern
28 part of the basin and the highest values near the Pyramid Peak area (Johnson 1990).

29
30 In 1975, it was estimated that water levels had declined up to 40 ft (12 m) since irrigation
31 began in 1949 in the basin; however, because of increased agricultural development in the
32 Ranegras Plain Basin, water levels continued to decline (Johnson 1990). Data collected from
33 1945 to 2006 show a decline in water levels ranging from 25 to 146 ft (7.6 to 44 m) throughout
34 the Ranegras Plain basin; however, a rebound of water levels ranging from 2.4 to 60 ft (0.7 to
35 18 m) has occurred in three of the four wells analyzed (USGS 2010b; wells 335622114005601,
36 334357113473201, 334121113450101, and 334839113514101). The withdrawals from the basin
37 have caused a cone of depression to form in the eastern part of the basin, approximately 10 mi
38 (16 km) from the Brenda SEZ, near Pyramid Peak (ADWR 2010b). Subsidence of the land
39 surface has also occurred as a result of overdraft of the aquifer. Between 1992 and 1997
40 subsidence of up to 1.9 in. (5 cm) was measured to occur in the area of the basin where the
41 highest drawdown has occurred (near Pyramid Peak) (ADWR 2010d). Between 2004 and 2010,
42 an additional land subsidence of up to 1.9 in. (5 cm) was measured in the same area
43 (ADWR 2010e).

44
45 Total dissolved solids (TDS) concentrations within the basin have been found to be
46 generally high (ADWR 2010b). Of 48 wells sampled, 43 were found to have TDS levels above

1 the secondary maximum contaminant level (MCL) of 500 mg/L (EPA 2009d) in samples taken
2 between 1985 and 1989. Out of a total of 91 samples tested in the basin, 7 had TDS
3 concentrations higher than 3,000 mg/L; at this level the water is considered “mineralized”
4 (ADWR 2010a). The highest TDS concentrations are in the north-central part of the basin.
5 The majority of the 48 samples also were found to have concentrations of fluoride that
6 exceeded the secondary MCL (4.0 mg/L) (ADWR 2010b). Concentrations of hexavalent
7 chromium in 13 out of 39 samples exceeded the 0.05 mg/L MCL, and concentrations of
8 selenium in 4 of 39 samples exceeded the 0.01 mg/L MCL (ADWR 2010b). Of the total number
9 of 91 samples reported to be taken between 1978 and 1990 that had concentrations exceeding
10 water quality standards, 55 exceeded the MCL for arsenic and 18 exceeded the MCL for nitrate
11 (ADWR 2010a). Concentrations of arsenic and fluoride have been found to exceed water quality
12 standards in the groundwater in the vicinity of the proposed Brenda SEZ (ADWR 2010a).

13 14 15 ***8.1.9.1.3 Water Use and Water Rights Management***

16
17 In 2005, water withdrawals from surface waters and groundwater in La Paz County
18 were 704,009 ac-ft/yr (86 million m³/yr), of which 87% came from surface waters and 13%
19 came from groundwater. The largest water use category was irrigation, at 698,886 ac-ft/yr
20 (86 million m³/yr). Public supply/domestic water uses accounted for 4,697 ac-ft/yr
21 (5.7 million m³/yr), with mining water uses on the order of 303 ac-ft/yr (386,000 m³/yr)
22 (Kenny et al. 2009). Within the Ranegras Plain Basin, the annual groundwater withdrawals
23 for agriculture were 29,500 ac-ft/yr (36 million m³/yr) between 1991 and 1995, 32,000 ac-ft/yr
24 (39 million m³/yr) between 1996 and 2000, and 28,800 ac-ft/yr (35 million m³/yr) between
25 2000 and 2005 (ADWR 2010a). Municipal water use from the Ranegras Plain Basin was
26 estimated to be less than 300 ac-ft/yr (<370,000 m³/yr) between 1991 and 1995, 300 ac-ft/yr
27 (370,000 m³/yr) between 1996 and 2000, and 400 ac-ft/yr (490,000 m³) between 2001 and 2005
28 (ADWR 2010a).

29
30 Arizona water law is based on the doctrine of prior appropriation. However, water laws in
31 Arizona are based on a bifurcated system in which surface water and groundwater rights are
32 administered and assessed separately. The state of Arizona has four main sources of water:
33 Colorado River water, surface water separate from the Colorado River, groundwater, and treated
34 effluent. Rights for these four sources are assessed and administered separately; Colorado River
35 water is regulated under the Law of the River, other surface water is based on prior
36 appropriation, and groundwater rights are handled on a region-by-region basis (BLM 2001).
37 Effluent is not available for use until it takes on the characteristics of surface water through
38 treatment (ADWR 2010k). The ADWR is the agency responsible for the conservation and
39 distribution of water in the state. It is also responsible for administering and assessment of novel
40 and transfer of existing water rights and applications. The agency’s broad goal is the security of
41 long-term dependable water supplies for the state, which is the main factor in the assessment of
42 water right applications (ADWR 2010j).

43
44 Upon completion of an application for water rights, the ADWR assesses it with three
45 main criteria: whether the proposed water right will conflict with more senior water rights,
46 whether the proposed right is a threat to public safety, and whether the proposed right will be

1 detrimental to the interests and welfare of the general public (BLM 2001). Generally, surface
2 water rights are assessed solely upon the criteria above, but they may also be subject to certain
3 management plans in specific areas put into effect by the ADWR. Unlike the majority of
4 groundwater rights that are bound to the land they occupy, users of surface water rights have the
5 option to change location of the water right but not the beneficial use (a change of beneficial use
6 application would need to be submitted). To change a surface water right's location, a "sever and
7 transfer" permit needs to be approved by the ADWR and the governing body of the irrigation
8 district or water users council of the proposed new location of the surface water right.
9 Evaluations of "sever and transfer" permits follow the same general evaluation guidelines as new
10 surface water rights, and the proposed new location of the right after the transfer is treated as a
11 new surface water right. The new surface water right must not exceed the old one in annual water
12 use (ADWR 2010k).

13
14 Arizona has rights to 2.8 million ac-ft of Colorado River water annually, which is further
15 sub-divided into allocations for both general Colorado River water users and Central Arizona
16 Project (CAP) users (ADWR 2010l). CAP is a system of water delivery canals, aqueducts, and
17 pumping stations that deliver 1.5 million ac-ft/yr of Colorado River water from Lake Havasu to
18 Pima, Pinal and Maricopa counties annually (CAP 2010). The flows of the Colorado River are
19 variable; and thus, the water resource availability is variable from year to year.

20
21 The Ground Water Management Code (the Code) was put into effect in 1980 because of
22 historic groundwater overdraft, where groundwater recharge is exceeded by discharge (in some
23 places groundwater overdraft is in excess of 700,000 ac-ft/yr [864 million m³/yr])
24 (ADWR 1999, 2010c). The Code describes three main goals for the state regarding the
25 management of groundwater: the control of severe overdraft, the allocation of the limited water
26 resources of the state, and the enhancement of the state's groundwater resources using water
27 supply development (BLM 2001). Arizona's groundwater management laws are separated
28 according to a three-tiered system based on The Code. Under that system, proposed applications
29 are evaluated with an increasing level of scrutiny. The lowest level of management includes
30 provisions that apply statewide, Irrigation Non-Expansion Areas (INAs) have an intermediate
31 level of management, and Active Management Areas (AMAs) have the highest level of
32 management with the most restrictions and provisions. Within an AMA or INA, a groundwater
33 permit is required (BLM 2001). Currently the state has five AMAs and three INAs, each with its
34 own specific rules and regulations regarding the appropriation of groundwater (ADWR 2010m).
35 In locations outside of designated AMAs and INAs, a permit is not necessary to withdraw
36 groundwater (BLM 2001). Use of this groundwater, however, requires the filing of a notice of
37 intent to drill with the ADWR.

38
39 Recently, the ADWR (2010k) has created guidelines regarding the appropriation of water
40 for solar generating facilities, specifically detailing what information needs to be submitted for
41 permit evaluation. Information that is required includes the proposed method of power
42 generation, the proposed amount of water to be consumed, the point of diversion, and to what or
43 to whom the power is to be distributed. To secure water rights for a solar facility to be located
44 within an AMA, the applicant must demonstrate that there is an "assured water supply" for the
45 life of the project. The ADWR then makes a decision based on whether the proposed water right
46 will be detrimental to public welfare and general conservation of water (ADWR 2010k).

1 Groundwater within the Brenda SEZ is located in the Ranegras Plain basin, which is part
2 of the Lower Colorado River Planning Area, as defined by the ADWR (2010a). Within the
3 Ranegras Plains Basin, there are no surface water rights available (e.g., from the Colorado
4 River), and the primary source of water resources is groundwater (ADWR 2010a). Since the
5 Ranegras Plains Basin is not included in either an AMA or INA, it is legal to pump groundwater
6 without a permit; however, a Notice of Intent to Drill must be filed with ADWR (2010c).
7 Groundwater level declines and associated land subsidence within the Ranegras Plain Basin
8 have resulted from overdraft of the aquifer. Groundwater withdrawals far exceed the estimated
9 recharge of the basin.

10 11 12 **8.1.9.2 Impacts**

13
14 Potential impacts on water resources related to utility-scale solar energy development
15 include direct and indirect impacts on surface waters and groundwater. Direct impacts occur at
16 the place of origin and at the time of the proposed activity, while indirect impacts occur away
17 from the place of origin or later in time. Impacts on water resources considered in this analysis
18 are the result of land disturbance activities (construction, final developed site plan, and off-site
19 activities such as road and transmission line construction) and water use requirements for solar
20 energy technologies that take place during the four project phases: site characterization,
21 construction, operations, and decommissioning/reclamation. Both land disturbance and
22 consumptive water use activities can affect groundwater and surface water flows, cause
23 drawdown of groundwater surface elevations, modify natural drainage pathways, obstruct natural
24 recharge zones, and alter surface water-wetland-groundwater connectivity. Water quality can
25 also be degraded through the generation of wastewater, chemical spills, increased erosion and
26 sedimentation, and increased salinity (e.g., by the excessive withdrawal from aquifers).

27 28 29 **8.1.9.2.1 Land Disturbance Impacts on Water Resources**

30
31 Impacts related to land disturbance activities are common to all utility-scale solar energy
32 projects and are described in more detail for the four phases of development in Section 5.9.1;
33 these impacts will be minimized through the implementation of programmatic design features
34 described in Appendix A, Section A.2.2. Land disturbance impacts in the vicinity of the Brenda
35 SEZ could potentially affect natural drainage patterns and natural groundwater recharge and
36 discharge properties. The alteration of natural drainage pathways during construction can lead to
37 impacts related to flooding. Land-disturbance activities should be avoided to the extent possible
38 in the vicinity of Bouse Wash and the unnamed ephemeral stream washes on the site. Alterations
39 to these systems could enhance erosion processes, disrupt groundwater recharge, and negatively
40 affect plant and animal habitats associated with the ephemeral channels. The Bouse Wash
41 conveys flows during storm events, as is evident from channel incision and sedimentation
42 patterns. In addition, water flowing in unnamed ephemeral washes off of the Bear Hills to the
43 southwest during storm events has created sedimentation and erosion patterns. Land disturbance
44 in the SEZ could potentially cause channel incision and sedimentation problems for these stream
45 systems and downstream in Bouse Wash.

1 **8.1.9.2.2 Water Use Requirements for Solar Energy Technologies**
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3

4 **Analysis Assumptions**
5

6 A detailed description of the water use assumptions for the four utility-scale solar energy
7 technologies (parabolic trough, power tower, dish engine, and PV systems) is presented in
8 Appendix M. Assumptions regarding water use calculations specific to the proposed Brenda SEZ
9 include the following:
10

- 11 • On the basis of a total area of 3,878 acres (15.7 km²), it is assumed that one
12 solar project would be constructed during the peak construction year;
- 13 • Water needed for making concrete would come from an off-site source;
- 14 • The maximum land disturbance for an individual solar facility during the peak
15 construction year is 3,000 acres (12 km²);
- 16 • Assumptions on individual facility size and land requirements (Appendix M),
17 along with the assumed number of projects and maximum allowable land
18 disturbance, result in the potential to disturb up to 77% of the SEZ' total area
19 during the peak construction year; and
- 20 • Water use requirements for hybrid cooling systems are assumed to be on the
21 same order of magnitude as those using dry cooling (see Section 5.9.2.1).
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28 **Site Characterization**
29

30 During site characterization, water would be used mainly for controlling fugitive dust and
31 for providing the workforce potable water supply. Impacts on water resources during this phase
32 of development are expected to be negligible, since activities would be limited in area, extent,
33 and duration; water needs could be met by trucking water in from an off-site source.
34
35

36 **Construction**
37

38 During construction, water would be used mainly for fugitive dust suppression and the
39 workforce potable water supply. Because there are no significant surface water bodies on the
40 proposed Brenda SEZ, the water requirements for construction activities could be met by either
41 trucking water to the sites or by using on-site groundwater resources. Water requirements for
42 dust suppression and potable water supply during the peak construction year, shown in
43 Table 8.1.9.2-1, could be as high as 2,014 ac-ft (2.5 million m³). The assumptions underlying
44 these estimates for each solar energy technology are described in Appendix M. Groundwater
45 wells would have to yield up to an estimated 1,250 gal/min (4,720 L/min) to meet the estimated
46 construction water requirements. This yield is within the range of producing wells within the

TABLE 8.1.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Brenda SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements ^a				
Fugitive dust control (ac-ft) ^{b,c}	1,313	1,969	1,969	1,969
Potable supply for workforce (ac-ft)	74	45	19	9
Total water use requirements (ac-ft)	1,387	2,014	1,988	1,979
Wastewater generated				
Sanitary wastewater (ac-ft)	74	45	19	9

^a Assumptions of water use for fugitive dust control, potable supply for workforce, and wastewater generation are presented in Table M.9-1 (Appendix M).

^b Fugitive dust control estimation assumes a local pan evaporation rate of 115 in./yr (292 cm/yr) (Cowherd et al. 1988).

^c To convert ac-ft to m³, multiply by 1,234.

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Ranegras Plain Basin and is typical of well yields of small to medium-sized farms in Arizona (ADWR 2010a; USDA 2009c). The availability of groundwater and the impacts of groundwater withdrawal would need to be assessed during the site characterization phase of a solar development project. In addition, up to 74 ac-ft (91,000 m³) of sanitary wastewater would be generated annually and would need to be either treated on-site or sent to an off-site facility. Groundwater quality in the vicinity of the SEZ has concentrations of arsenic and fluoride that exceed drinking quality standards (ADWR 2010a). Water would need to be treated or imported to meet drinking water quality standards for potable water.

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Operations

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During operations, water would be required for mirror/panel washing, the workforce potable water supply, and cooling (parabolic trough and power tower only) (Table 8.1.9.2-2). Water needs for cooling are a function of the type of cooling used (dry, hybrid, wet). Further refinements to water requirements for cooling would result from the percentage of time the option was employed (30 to 60% range assumed) and the power of the system. The differences between the water requirements reported in Table 8.1.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per megawatt. As a result, the water usage for the more energy-dense parabolic trough technology is estimated to be almost twice as large as that for the power tower technology.

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Water use requirements among the solar energy technologies are a factor of the full build-out capacity for the SEZ, as well as assumptions on water use and technology operations discussed in Appendix M. Table 8.1.9.2-2 lists the quantities of water needed for mirror/panel washing, potable water supply, and cooling activities for each solar energy technology. At full

TABLE 8.1.9.2-2 Estimated Water Requirements during Operations at the Proposed Brenda SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW) ^{a,b}	620	345	345	345
Water use requirements				
Mirror/panel washing (ac-ft/yr) ^{c,d}	310	172	172	17
Potable supply for workforce (ac-ft/yr)	9	4	4	0.4
Dry cooling (ac-ft/yr) ^e	124–620	69–345	NA ^f	NA
Wet cooling (ac-ft/yr) ^e	2,792–8,997	1,551–4,998	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	176	18
Dry-cooled technologies (ac-ft/yr)	443–940	245–521	NA	NA
Wet-cooled technologies (ac-ft/yr)	3,111–9,316	1,727–5,175	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr) ^g	176	98	NA	NA
Sanitary wastewater (ac-ft/yr)	9	4	4	0.4

- ^a Land area for parabolic trough was estimated at 5 acres/MW (0.02 km²/MW); land area for the power tower, dish engine, and PV technologies was estimated at 9 acres/MW (0.04 km²/MW).
- ^b Water needs are linearly related to power. Water usage for any other size project can be estimated by using multipliers provided in Table M.9-2 (Appendix M).
- ^c Value assumes a usage rate of 0.5 ac-ft/yr/MW for mirror washing for parabolic trough, power tower, and dish engine technologies and a rate of 0.05 ac-ft/yr/MW for panel washing for PV systems.
- ^d To convert ac-ft to m³, multiply by 1,234.
- ^e Dry-cooling value assumes 0.2 to 1.0 ac-ft/yr per MW and wet-cooling value assumes 4.5 to 14.5 ac-ft/yr per MW (range in these values represents 30 and 60% operating times) (DOE 2009).
- ^f NA = not applicable.
- ^g Value scaled from 250-MW Beacon Solar project with an annual discharge of 44 gpm (167 L/min) (AECOM 2009). Blowdown estimates are relevant to wet cooling only.

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2
3 build-out capacity, the estimated total water use requirements for non-cooling technologies
4 (i.e., technologies that do not use water for cooling) during operations are 18 and 176 ac-ft/yr
5 (22,000 to 220,000 m³/yr) for the PV and dish engine technologies, respectively. For
6 technologies that use water for cooling (i.e., parabolic trough and power tower), total water
7 needs range from 245 ac-ft/yr (0.3 million m³/yr) (power tower for an operating time of 30%
8 using dry cooling) to 9,316 ac-ft/yr (11.5 million m³/yr) (parabolic trough for an operating
9 time of 60% using wet cooling). Operations would generate up to 9 ac-ft/yr (11,100 m³/yr) of
10 sanitary wastewater; in addition, for wet-cooled technologies, 98 to 176 ac-ft/yr (120,000 to
11 220,000 m³/yr) of cooling system blowdown water would need to be either treated on-site or sent
12 to an off-site facility. Any on-site treatment of wastewater would have to ensure that treatment
13 ponds are effectively lined to prevent any groundwater contamination.
14

1 Water demands during operations would most likely be met by withdrawing groundwater
2 from wells constructed on-site. Non-cooled technologies—PV system and dish engine—would
3 require 11 gpm (42 L/min) and 110 gpm (410 L/min), respectively. Cooled technologies
4 (parabolic trough and power tower) would require well yields between 150 and 580 gal/min
5 (570 and 2,200 L/min) for dry cooling and between 1,100 and 5,800 gal/min (4,100 and
6 22,000 L/min) for wet cooling. The required well yields for dry cooling are within the range of
7 well yields within the Ranegras Plain Basin; wet-cooling water demands would mostly exceed
8 the average annual yield for a single well within the basin (ADWR 2010a). For wet cooling,
9 multiple wells would be required. Water demands for non-cooled technologies are substantially
10 less than those for cooled technologies.

11
12 Water demands for wet-cooling technologies are significant compared to the overall
13 water balance in the Ranegras Plain Basin aquifer. The estimates of annual groundwater recharge
14 for the Ranegras Plain Basin are from less than 1,000 to 6,000 ac-ft/yr (1.2 million to 7.4 million
15 m³/yr), and the higher end estimates of water required for wet cooling significantly exceed
16 recharge estimates. For the Brenda SEZ, estimated water requirements for wet cooling are
17 equivalent to 6 to 31% of the total average annual groundwater withdrawals in the basin between
18 1991 and 2005 (ADWR 2010a). However, the basin is already in a condition of overdraft. That
19 is, withdrawal from wells (about 30,000 ac-ft/yr [37 million m³]) exceeds the upper estimate for
20 the basin's annual recharge (6,000 ac-ft [7.5 million m³]) (ADWR 2010a). Additional water
21 supply wells for a solar project would worsen the basin's overdraft condition. The estimated
22 water requirements for wet cooling are equivalent to 34 to 190% of the annual recharge for the
23 Ranegras Plain basin, most recently estimated to be 5,000 ac-ft/yr (6.2 million m³/yr). Use of
24 water for wet cooling could exacerbate existing conditions of groundwater overdraft in the
25 Ranegras Plain basin. Based on the information presented here, wet cooling for the full build-out
26 scenario is not deemed feasible for the Brenda SEZ. To the extent possible, facilities using dry
27 cooling should implement water conservation practices to limit water needs.

28
29 The availability of water rights and the impacts associated with groundwater withdrawals
30 would need to be assessed during the site characterization phase of a proposed solar project. Less
31 water would be needed for any of the four solar technologies if the full build-out capacity were
32 reduced. The analysis of water use for the various solar technologies assumed a single
33 technology for full build-out. Water use requirements for development scenarios that assume a
34 mixture of solar technologies can be estimated using water use factors described in Appendix M,
35 Section M.9.

36
37 The effects of groundwater withdrawal rates on potential drawdown of groundwater
38 elevations and flow directions would need to be assessed during the site characterization phase
39 of a solar project and during the development of water supply wells. In the Ranegras Plain
40 Groundwater Basin, water levels have declined by up to 85 ft (4.6 m), and surface elevations are
41 subsiding at a maximum rate of about 0.3 in./yr (0.8 cm/yr) (ADWR 2010e) because of declining
42 groundwater levels (ADWR 2010f). With these existing conditions, further groundwater
43 withdrawals for solar energy development at the SEZ would potentially cause further drawdown
44 of groundwater elevations and land subsidence in the vicinity of the SEZ. These indirect impacts
45 could disturb regional groundwater flow patterns and recharge patterns, potentially affecting
46 ecological habitats (see discussion in Section 8.1.10).

1 Concentrations of arsenic and fluoride have been found to exceed water quality standards
2 in the groundwater in the vicinity of the proposed Brenda SEZ (ADWR 2010a), so groundwater
3 would need to be treated or potable water would need to be imported into the area to support
4 potable needs at solar energy facilities.
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7 **Decommissioning/Reclamation**

8

9 During decommissioning/reclamation, all surface structures associated with the solar
10 project would be dismantled, and the site reclaimed to its preconstruction state. Activities and
11 water needs during this phase would be similar to those during the construction phase (dust
12 suppression and potable supply for workers) and might also include water to establish vegetation
13 in some areas. However, the total volume of water needed is expected to be less. Because
14 quantities of water needed during the decommissioning/reclamation phase would be less than
15 those for construction, impacts on surface and groundwater resources also would be less.
16
17

18 ***8.1.9.2.3 Off-Site Impacts: Roads and Transmission Lines***

19

20 U.S. 60 is adjacent to the southern border of the proposed Brenda SEZ, and as described
21 in Section 8.1.1.2, the nearest transmission line is located approximately 19 mi (31 km) west of
22 the SEZ. Impacts associated with the construction of roads and transmission lines primarily deal
23 with water use demands for construction, water quality concerns relating to potential chemical
24 spills, and land disturbance effects on the natural hydrology. Water needed for transmission
25 line construction activities (e.g., for soil compaction, dust suppression, and potable supply for
26 workers) could be trucked to the construction area from an off-site source. As a result, water use
27 impacts would be negligible. Impacts on surface water and groundwater quality resulting from
28 spills would be minimized by implementing the mitigation measures described in Section 5.9.3
29 (e.g., cleaning up spills as soon as they occur). Ground-disturbing activities that have the
30 potential to increase sediment and dissolved solid loads in downstream waters would be
31 conducted following the mitigation measures outlined in Section 5.9.3 to minimize impacts
32 associated with alterations to natural drainage pathways and hydrologic processes.
33
34

35 ***8.1.9.2.4 Summary of Impacts on Water Resources***

36

37 The impacts on water resources associated with solar energy development at the
38 proposed Brenda SEZ are associated with land disturbance effects on the natural hydrology,
39 water quality concerns, and water use requirements for the various solar energy technologies.
40 Impacts relating to water use requirements vary depending on the type of solar technology built
41 and, for technologies using cooling systems, the type of cooling (wet, dry, hybrid) employed.
42 Water requirements would be greatest for wet-cooled parabolic trough and power tower
43 facilities. Dry cooling reduces water use requirements by approximately a factor of 10, compared
44 with wet cooling. PV requires the least amount of water among the solar energy technologies.
45 The estimates of groundwater recharge, discharge, underflow from adjacent basins, and historical
46 data on groundwater extractions and groundwater surface elevations suggest that there is not

1 enough water available to support the water-intensive technologies, such as those using wet
2 cooling for the full build-out scenario.

3
4 Because the Brenda SEZ is not located within a designated AMA or INA, no
5 groundwater permit would be required for groundwater supply wells. However, an application
6 to drill would have to be submitted to the state, and the groundwater extraction plans would
7 have to be approved by the ADWR. The portion of the basin that contains the proposed SEZ (the
8 Date Creek basin) was estimated to have a recharge of between 1,000 and 6,000 ac-ft/yr
9 (1.2 million to 7.4 million m³/yr). In addition, the sustainable yield has not been assessed for the
10 basin; and thus, impacts of groundwater withdrawals on aquifer drawdown and potentially land
11 subsidence would need to be investigated. Using water supply wells for the solar project in the
12 basin (particularly for projects that use wet cooling) would worsen overdraft conditions and
13 could increase land subsidence in the vicinity of the solar project. Land subsidence could impact
14 the long-term storage capacity of the underlying aquifer by causing permanent damage due to
15 compaction.

16
17 In addition, the water quality in many parts of the basin does not comply with drinking
18 water quality standards, so groundwater would need to be treated or potable water would need
19 to be imported into the area to support potable needs at solar energy facilities.

20
21 Land-disturbance activities can cause localized erosion and sedimentation issues, as
22 well as alter groundwater recharge and discharge processes. Bouse Wash provides significant
23 recharge to the Ranegras Plain Basin, and land disturbance activities in the vicinity of Bouse
24 Wash and its tributaries could significantly affect groundwater recharge in the basin. Land
25 disturbance within the SEZ could affect channel erosion and sedimentation patterns in Bouse
26 Wash and also in the ephemeral washes that drain the Bear Hills to the southwest.

27 28 29 **8.1.9.3 SEZ-Specific Design Features and Design Feature Effectiveness**

30
31 Implementing the programmatic design features described in Appendix A, Section A.2.2,
32 as required under BLM's Solar Energy Program, would mitigate some impacts on water
33 resources. Programmatic design features would focus on coordinating with federal, state, and
34 local agencies that regulate the use of water resources to meet the requirements of permits and
35 approvals needed to obtain water for development, and on conducting hydrological studies to
36 characterize the aquifer from which groundwater would be obtained (including drawdown
37 effects, if a new point of diversion is created). The greatest consideration for mitigating water
38 impacts would be in the selection of solar technologies. The mitigation of impacts would be best
39 achieved by selecting technologies with low water demands.

40
41 Proposed design features specific to the Brenda SEZ include the following:

- 42
43 • Wet-cooling options would not be feasible; other technologies should
44 incorporate water conservation measures.

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- During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain.
- Before drilling a new well within the Ranegras Plain basin, a Notice of Intent to Drill must be filed with the ADWR, and any groundwater rights policy of the ADWR must be followed (ADWR 2010c).
- Groundwater monitoring and production wells should be constructed in accordance with state standards (ADWR 2010g).
- Stormwater management plans and best management practices (BMPs) should comply with standards developed by the Arizona Department of Environmental Quality (ADEQ 2010).
- Water for potable uses would have to meet or be treated to meet drinking water quality standards.
- Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site.

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8.1.10 Vegetation

This section addresses vegetation that could occur or is known to occur within the potentially affected area of the proposed Brenda SEZ. The affected area considered in this assessment includes the areas of direct and indirect effects. The area of direct effects is defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and includes the SEZ and a 250-ft (76-m) wide portion of an assumed transmission line corridor. The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary or within the 1-mi (1.6-km) wide assumed transmission line corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect.

Indirect effects considered in the assessment include effects from surface runoff, dust, and accidental spills from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area is the area bounded by the areas of direct and indirect effects. These areas are defined and the impact assessment approach is described in Appendix M.

8.1.10.1 Affected Environment

The proposed Brenda SEZ is located within the Sonoran Basin and Range Level III ecoregion (EPA 2007), which supports creosotebush- (*Larrea tridentata*) white bursage (*Ambrosia dumosa*) plant communities with large areas of palo verde- (*Parkinsonia microphylla*) cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western honey mesquite (*Prosopis glandulosa* var. *torreyana*) dominant in some areas (Turner and Brown 1994). Larger drainageways and washes support species of small trees and shrubs that may also occur in adjacent areas, such as western honey mesquite, ironwood (*Olneya tesota*), and blue palo verde (*Parkinsonia florida*), as well as species such as smoketree (*Psoralea arguta*) that are mostly restricted to drainageways. Shrub species found in minor drainages include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola* var. *pentalepis*), Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). Annual precipitation in the Sonoran Desert occurs in winter and summer (Turner and Brown 1994), and is very low in the area of the SEZ, averaging about 5.6 in. (14 cm) at Bouse, Arizona (see Section 8.1.13).

Land cover types described and mapped under the Southwest Regional Gap Analysis Project (SWReGAP) (USGS 2005a) were used to evaluate plant communities in and near the SEZ. Each cover type encompasses a range of similar plant communities. Land cover types occurring within the potentially affected area of the proposed Brenda SEZ are shown in Figure 8.1.10.1-1. Table 8.1.10.1-1 lists the surface area of each cover type within the potentially affected area.

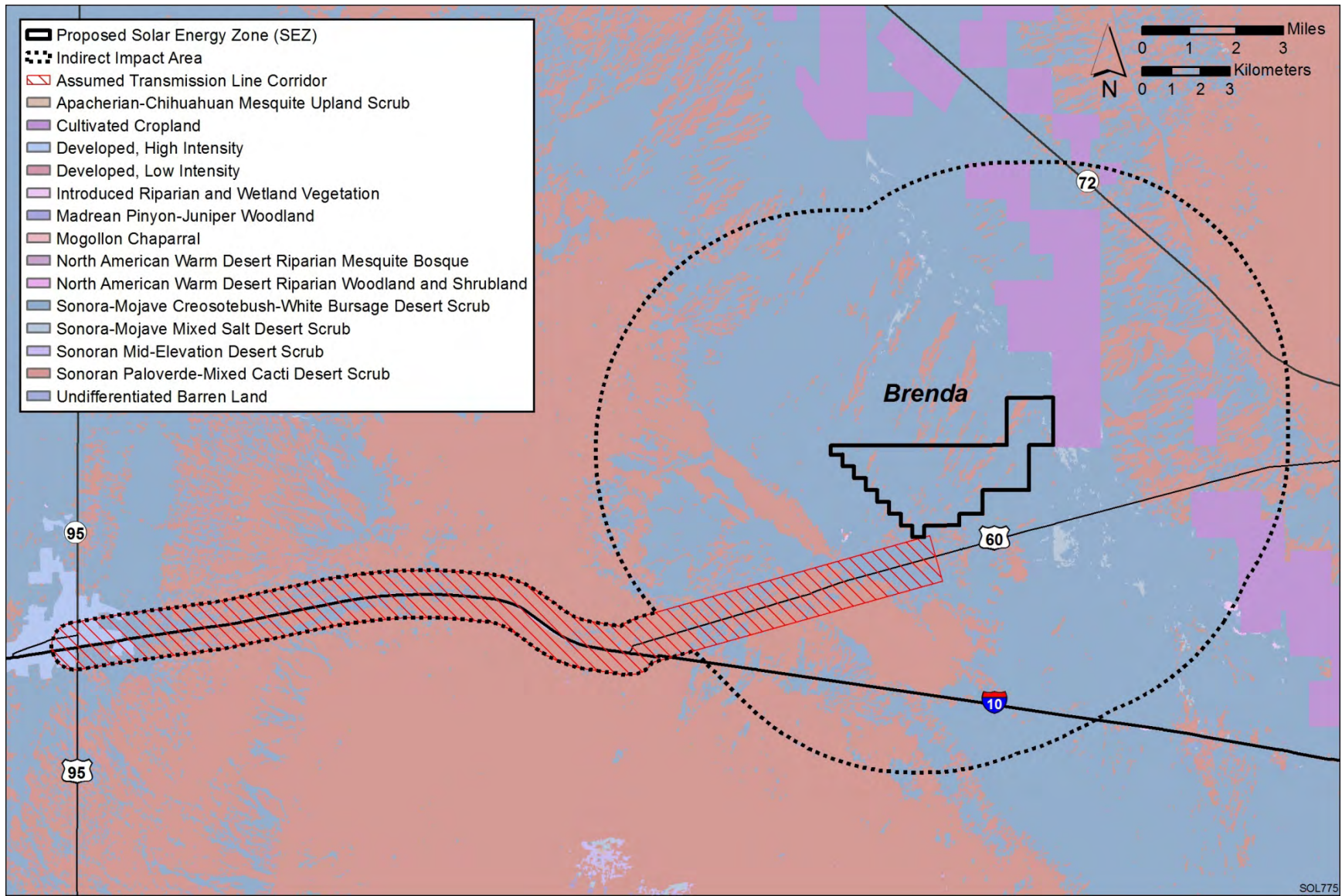


FIGURE 8.1.10.1-1 Land Cover Types within the Proposed Brenda SEZ (Source: USGS 2004)

TABLE 8.1.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Brenda SEZ and Potential Impacts

Land Cover Type ^a	Area of Cover Type Affected (acres) ^b			
	Within SEZ (Direct Effects) ^c	Assumed Transmission Line (Direct Effects) ^d	Corridor and Outside SEZ (Indirect Effects) ^e	Overall Impact Magnitude ^f
Sonora–Mojave Creosotebush–White Bursage Desert Scrub: Occurs in broad valleys, lower bajadas, plains, and low hills in the Mojave and Sonoran deserts. Shrubs form a sparse to moderately dense cover (2 to 50%), although the ground surface may be mostly barren. The dominant species are typically creosotebush (<i>Larrea tridentata</i>) and white bursage (<i>Ambrosia dumosa</i>). Other shrubs, dwarf-shrubs, and cacti may also be dominant or form sparse understories. Herbaceous species are typically sparse, but may be seasonally abundant.	3,422 acres ^g (0.2%, 0.3%)	177 acres (<0.1%)	59,140 acres (2.6%)	Small
Sonoran Paloverde-Mixed Cacti Desert Scrub: Occurs on hillsides, mesas, and upper bajadas. The tall shrubs yellow palo verde (<i>Parkinsonia microphylla</i>) and creosotebush (<i>Larrea tridentata</i>), which are sparse to moderately dense, and/or sparse saguaro cactus (<i>Carnegiea gigantea</i>) characterize the vegetation. Other shrubs and cacti are typically present. Perennial grasses and forbs are sparse. Annual species are seasonally present and may be abundant.	428 acres (<0.1%, <0.1%)	346 acres (<0.1%)	30,924 acres (1.5%)	Small
Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	12 acres (<0.1%, 0.1%)	0 acres	7,077 acres (2.3%)	Small
Sonora-Mojave Mixed Salt Desert Scrub: Extensive open-canopied shrublands in the Mojave and Sonoran Deserts, usually occurring around playas and in valley bottoms or basins with saline soils. Vegetation is typically composed of one or more <i>Atriplex</i> species; other salt-tolerant plants are often present or even co-dominant. Grasses occur at varying densities.	9 acres (0.1%, 0.3%)	<1 acre (<0.1%)	533 acres (5.6%)	Small

TABLE 8.1.10.1-1 (Cont.)

Land Cover Type ^a	Area of Cover Type Affected (acres) ^b			
	Within SEZ (Direct Effects) ^c	Assumed Transmission Line (Direct Effects) ^d	Corridor and Outside SEZ (Indirect Effects) ^e	Overall Impact Magnitude ^f
Developed, Medium-High Intensity: Includes housing and commercial/industrial development. Impervious surfaces compose 50 to 100% of the total land cover.	0 acres	48 acres (0.4%)	1,291 acres (10.9%)	Small
Barren lands non-specific: Includes a variety of barren areas, generally with less than 15% cover of vegetation.	0 acres	2 acres (<0.1%)	111 acres (1.3%)	Small
North American Warm Desert Riparian Mesquite Bosque: Occurs along perennial and intermittent streams as relatively dense riparian corridors composed of trees and shrubs. Honey mesquite (<i>Prosopis glandulosa</i>) and velvet mesquite (<i>P. velutina</i>) are the dominant trees. Vegetation is supported by groundwater when surface water is absent.	0 acres	<1 acre (<0.1%)	8 acres (0.1%)	Small
Invasive Southwest Riparian Woodland and Shrubland: Dominated by non-native riparian trees and shrubs.	0 acres	0 acres	26 acres (0.3%)	Small
North American Warm Desert Riparian Woodland and Shrubland: Occurs along medium to large perennial streams in canyons and desert valleys. Consists of a mix of riparian woodlands and shrublands. Vegetation is dependent upon annual or periodic flooding, along with substrate scouring, and/or a seasonally shallow water table.	0 acres	0 acres	2 acres (<0.1%)	Small

^a Land cover descriptions are from USGS (2005a). Full descriptions of land cover types, including plant species, can be found in Appendix I.

^b Area in acres, determined from USGS (2004).

Footnotes continued on next page.

TABLE 8.1.10.1-1 (Cont.)

-
- ^c Includes the area of the cover type within the SEZ, the percentage that area represents of all occurrences of that cover type within the SEZ region (i.e., a 50-mi [80-km] radius from the center of the SEZ), and the percentage that area represents of all occurrences of that cover type on BLM lands within the SEZ region. The SEZ region intersects portions of California and Arizona. However, the SEZ and affected area occur only in Arizona.
- ^d For transmission development, direct effects were estimated within a 19-mi (31-km) long, 250-ft (76-m) wide assumed transmission ROW from the SEZ to the nearest existing line. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide transmission corridor. Impacts are for the area of the cover type within the assumed ROW, and the percentage that area represents of all occurrences of that cover type within the SEZ region.
- ^e Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portions of the 1-mi (1.6-km) wide transmission corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. Includes the area of the cover type within the indirect effects area and the percentage that area represents of all occurrences of that cover type within the SEZ region.
- ^f Overall impact magnitude categories were based on professional judgment and include (1) *small*: a relatively small proportion ($\leq 1\%$) of the cover type within the SEZ region would be lost; (2) *moderate*: an intermediate proportion (> 1 but $\leq 10\%$) of a cover type would be lost; (3) *large*: $> 10\%$ of a cover type would be lost.
- ^g To convert acres to km^2 , multiply by 0.004047.

1 Lands within the proposed Brenda SEZ are classified primarily as Sonora–Mojave
2 Creosotebush–White Bursage Desert Scrub. Additional cover types within the SEZ are given in
3 Table 8.1.10.1-1. During a September 2009 visit to the site, dominant species observed in the
4 desertscrub communities present within the SEZ included creosotebush, saguaro cactus, palo
5 verde, ironwood, and acacia. Characteristic Sonoran Desert species observed on the SEZ include
6 these as well as ocotillo. Cacti species observed within the SEZ included saguaro cactus, cholla
7 (*Opuntia* sp.), and barrel cactus (*Ferocactus cylindraceus*). Sensitive habitats on the SEZ include
8 desert dry wash, dry wash woodlands, and desert chenopod scrub/mixed salt desert scrub.
9 Cryptogammic soil crusts occur in some areas of the SEZ. While portions of the SEZ support a
10 sparse creosotebush community with few associated species, other areas of the SEZ support a
11 high-quality, diverse, Sonoran desertscrub community.

12
13 The indirect impact area, including the area within 5 mi (8 km) around the SEZ and the
14 transmission line corridor, includes nine cover types, which are listed in Table 8.1.10.1-1. The
15 predominant cover types are Sonora–Mojave Creosotebush–White Bursage Desert Scrub and
16 Sonoran Paloverde–Mixed Cacti Desert Scrub.

17
18 No National Wetland Inventory (NWI) data are available for the region that includes the
19 proposed Brenda SEZ (USFWS 2009a). Numerous ephemeral desert dry washes occur within the
20 SEZ, generally flowing to the northeast. These washes typically do not support wetland or
21 riparian habitats. Bouse Wash, a large ephemeral wash, is located within the northeast portion of
22 the SEZ and consists of a wide, shallow, braided channel. These dry washes typically contain
23 water for short periods during or following precipitation events, and include temporarily flooded
24 areas. Tyson Wash, located near the western end of the assumed transmission line corridor,
25 supports dry wash woodland habitat south of Highway 10 (BLM 2007a). Small areas of North
26 American Warm Desert Riparian Mesquite Bosque occur in scattered dry washes within the
27 corridor.

28
29 The State of Arizona maintains an official list of weed species that are designated
30 noxious species (AZDA 2010). Table 8.1.10.1-2 provides a summary of the noxious weed
31 species regulated in Arizona that are known to occur in La Paz County (USDA 2010a), which
32 includes the proposed Brenda SEZ. No species included in Table 8.1.10.1-2 was observed on the
33 SEZ in August 2009.

34
35 The Arizona Department of Agriculture classifies noxious weeds into one of three
36 categories (AZDA 2010):

- 37
38
- 39 • “Prohibited: Noxious weeds (includes plants, stolons, rhizomes, cuttings, and
40 seed) that are prohibited from entry into the state.”
 - 41 • “Regulated: Noxious weeds that are regulated (includes plants, stolons,
42 rhizomes, cuttings, and seed) and if found within the state may be controlled
43 or quarantined to prevent further infestation or contamination.”
- 44

TABLE 8.1.10.1-2 Designated Noxious Weeds of Arizona Occurring in Le Paz County

Common Name	Scientific Name	Category
Dodder	<i>Cuscuta</i> spp.	Restricted, prohibited
Field bindweed	<i>Convolvulus arvensis</i>	Regulated, prohibited
Morning glory	<i>Ipomoea</i> spp.	Prohibited
Puncture vine	<i>Tribulus terrestris</i>	Regulated, prohibited

Sources: AZDA (2010); USDA (2010a).

- “Restricted: Noxious weeds that are restricted (includes plants, stolons, rhizomes, cuttings, and seed) and if found within the state shall be quarantined to prevent further infestation or contamination.”

Table 8.1.10.1-3 provides a summary of the federal regulated and restricted invasive plant species that are known to occur in the BLM Lake Havasu Field Office Planning Area (BLM 2007a), which includes the proposed Brenda SEZ. No species included in Table 8.1.10.1-3 was observed on the SEZ in August 2009.

8.1.10.2 Impacts

The construction of solar energy facilities within the proposed Brenda SEZ would result in direct impacts on plant communities due to the removal of vegetation within the facility footprint during land-clearing and land-grading operations. Approximately 80% of the SEZ (3,102 acres [12.6 km²]) would be expected to be cleared with full development of the SEZ. The plant communities affected would depend on facility locations, and could include any of the communities occurring on the SEZ. Therefore, for the purposes of this analysis, all the area of each cover type within the SEZ is considered to be directly affected by removal with full development of the SEZ.

Indirect effects (caused, for example, by surface runoff or dust from the SEZ) have the potential to degrade affected plant communities and may reduce biodiversity by promoting the decline or elimination of species sensitive to disturbance. Indirect effects can also cause an increase in disturbance-tolerant species or invasive species. High impact levels could result in the elimination of a community or the replacement of one community type by another. The proper implementation of programmatic design features, however, would reduce indirect effects to a minor or small level of impact.

Possible impacts from solar energy facilities on vegetation that are encountered within the SEZ are described in more detail in Section 5.10.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A,

TABLE 8.1.10.1-3 Invasive Plant Species Occurring in the Lake Havasu Field Office Planning Area

Common Name	Scientific Name
Downy brome	<i>Bromus tectorum</i>
Musk thistle	<i>Carduus nutans</i>
Russian knapweed	<i>Acroptilon repens</i>
Saltcedar	<i>Tamarix</i> spp.
Scotch thistle	<i>Onopordium acanthium</i>
Spotted knapweed	<i>Centaurea maculosa</i>
Yellow star thistle	<i>Centaurea solstitialis</i>
Common reed	<i>Phragmites australis</i>
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>
Giant reed	<i>Arundo donax</i>
Giant salvinia	<i>Salvinia molesta</i>

Source: BLM (2007b).

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Section A.2.2, and any additional mitigation applied. Section 8.1.10.2.3, below, identifies design features of particular relevance to the proposed Brenda SEZ.

8.1.10.2.1 Impacts on Native Species

The impacts of construction, operation, and decommissioning were considered small if the impact affected a relatively small proportion (<1%) of the cover type in the SEZ region (within 50 mi [80 km] of the center of the SEZ); a moderate impact (>1 but <10%) could affect an intermediate proportion of a cover type; a large impact could affect greater than 10% of a cover type.

Solar facility construction and operation in the proposed Brenda SEZ would primarily affect communities of the Sonora–Mojave Creosotebush–White Bursage Desert Scrub cover type. Additional cover types that would be affected within the SEZ include Sonoran Paloverde–Mixed Cacti Desert Scrub, Agriculture, and Sonora-Mojave Mixed Salt Desert Scrub. The Agriculture cover type would likely have relatively minor populations of native species. Table 8.1.10.1-1 summarizes the potential impacts on land cover types resulting from solar energy facilities in the proposed Brenda SEZ. Most of these cover types are relatively common in the SEZ region; however, Sonora-Mojave Mixed Salt Desert Scrub is relatively uncommon, representing 0.2% of the land area within the SEZ region. In addition, Barren Lands, Non-specific (0.2%); North American Warm Desert Riparian Mesquite Bosque (0.2%); and Sonora-Mojave Mixed Salt Desert Scrub (0.2%), would potentially be impacted by the transmission line ROW. Desert dry wash, dry wash woodlands, desert chenopod scrub/mixed salt desert scrub, and mesquite bosque are important sensitive habitats in the region.

1 The construction, operation, and decommissioning of solar projects within the proposed
2 Brenda SEZ would result in small impacts on all cover types in the affected area.

3
4 Because of the arid conditions, re-establishment of desert scrub communities in
5 temporarily disturbed areas would likely be very difficult and might require extended periods
6 of time. In addition, noxious weeds could become established in disturbed areas and colonize
7 adjacent undisturbed habitats; thus, reducing restoration success and potentially resulting in
8 widespread habitat degradation. Cryptogamic soil crusts occur in portions of the SEZ and in
9 many of the shrubland communities in the region. Damaging these crusts, as by the operation
10 of heavy equipment or other vehicles, can alter important soil characteristics, such as nutrient
11 cycling and availability, and affect plant community characteristics (Lovich and
12 Bainbridge 1999).

13
14 The deposition of fugitive dust from large areas of disturbed soil onto habitats outside
15 a solar project area could result in reduced productivity or changes in plant community
16 composition. Fugitive dust deposition could affect plant communities of each of the cover
17 types occurring within the indirect impact area identified in Table 8.1.10.1-1.

18
19 Grading could affect dry washes within the SEZ and transmission line corridor. Desert
20 dry washes in the SEZ support woodlands that include ironwood and blue palo verde. Within the
21 transmission line corridor, dry wash woodland occurs along Tyson Wash, and small areas of
22 mesquite bosque occur in scattered dry washes. Alteration of surface drainage patterns or
23 hydrology could adversely affect downstream dry wash communities. Vegetation within these
24 communities could be lost by erosion or desiccation. Communities associated with intermittently
25 flooded areas, such as chenopod scrub communities, downgradient from solar projects in the
26 SEZ could be affected by ground-disturbing activities. Site clearing and grading could disrupt
27 surface water, resulting in changes in the frequency, duration, depth, or extent of inundation or
28 soil saturation, and could potentially alter plant communities and affect community function.
29 Increases in surface runoff from a solar energy project site could also affect hydrologic
30 characteristics of these communities. The introduction of contaminants into these habitats could
31 result from spills of fuels or other materials used on a project site. Soil disturbance could result in
32 sedimentation in these areas, which could degrade or eliminate sensitive plant communities. See
33 Section 8.1.9 for further discussion of impacts on washes. Direct impacts on desert washes that
34 are Waters of the United States would require permitting from the U.S. Army Corps of Engineers
35 under Section 404 of the Clean Water Act.

36
37 Although the use of groundwater within the Brenda SEZ for technologies with high
38 water requirements such as wet-cooling systems may be unlikely, groundwater withdrawals
39 for such systems could reduce groundwater elevations. Communities that depend on accessible
40 groundwater, such as mesquite bosque communities, could become degraded or lost as a result
41 of lowered groundwater levels.

1 **8.1.10.2 Impacts from Noxious Weeds and Invasive Plant Species**
2

3 On February 8, 1999, President Bill Clinton signed E.O. 13112, “Invasive Species,”
4 which directs federal agencies to prevent the introduction of invasive species and provide for
5 their control, and to minimize the economic, ecological, and human health impacts of invasive
6 species (*Federal Register*, Volume 64, page 61836, Feb. 8, 1999). Potential impacts of noxious
7 weeds and invasive plant species resulting from solar energy facilities are described in
8 Section 5.10.1. Despite required programmatic design features to prevent the spread of noxious
9 weeds, project disturbance could potentially increase the prevalence of noxious weeds and
10 invasive species in the affected area of the proposed Brenda SEZ, such that weeds could be
11 transported into areas that were previously relatively weed-free, which could result in reduced
12 restoration success and possible widespread habitat degradation.
13

14 Species designated as noxious weeds in Arizona and known to occur in La Paz County
15 are listed in Table 8.1.10.1-2; species designated as federal regulated and restricted invasive
16 species and known to occur in the Lake Havasu Field Office Planning Area are given in
17 Table 8.1.10.1-3. Past or present land uses may affect the susceptibility of plant communities to
18 the establishment of noxious weeds and invasive species. Small areas of Invasive Southwest
19 Riparian Woodland and Shrubland totaling about 26 acres (0.1 km²) occur in the indirect impact
20 area; about 1,291 acres (5.2 km²) of Developed, Medium-High Intensity occur within the
21 indirect impact area, including the transmission line corridor. The developed areas likely support
22 few native plant communities. Because disturbance may promote the establishment and spread of
23 invasive species, developed areas may provide sources of such species. Existing roads and
24 recreational OHV use within the SEZ area of potential impact also likely contribute to the
25 susceptibility of plant communities to the establishment and spread of noxious weeds and
26 invasive species.
27

28
29 **8.1.10.3 SEZ-Specific Design Features and Design Feature Effectiveness**
30

31 In addition to programmatic design features, SEZ-specific design features would reduce
32 the potential for impacts on plant communities. While the specifics of some of these practices are
33 best established when considering specific project details, the following measures can be
34 identified at this time:
35

- 36 • An Integrated Vegetation Management Plan, addressing invasive species
37 control, and an Ecological Resources Mitigation and Monitoring Plan,
38 addressing habitat restoration, should be approved and implemented to
39 increase the potential for successful restoration of creosotebush–white bursage
40 desert scrub communities and other affected habitats and to minimize the
41 potential for the spread of noxious weeds or invasive species, such as those
42 occurring in La Paz County or the Lake Havasu Field Office Planning Area,
43 that could be introduced as a result of solar energy project activities (see
44 Section 8.1.10.2.2). To reduce the use of herbicides, invasive species control
45 should focus on biological and mechanical methods where possible.
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- All dry wash, dry wash woodland, chenopod scrub habitats, and saguaro cactus communities within the SEZ and all dry wash, dry wash woodland, mesquite bosque, chenopod scrub, and saguaro cactus communities within the assumed transmission line corridor should be avoided to the extent practicable and any impacts minimized and mitigated. A buffer area should be maintained around dry washes, dry wash woodland, and mesquite bosque habitats to reduce the potential for impacts.
- Appropriate engineering controls should be used to minimize impacts on dry wash, dry wash woodland, mesquite bosque, and chenopod scrub, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation.
- Transmission line towers should be sited and constructed to minimize impacts on dry washes, dry wash woodlands, and mesquite bosque communities; towers should span such areas whenever practicable.
- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities.

If these SEZ-specific design features are implemented in addition to programmatic design features, it is anticipated that a high potential for impacts from invasive species and potential impacts on dry wash, dry wash woodland, chenopod scrub, mesquite bosque, and saguaro cactus communities would be reduced to a minimal potential for impact.

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1 **8.1.11 Wildlife and Aquatic Biota**

2
3 This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic
4 biota that could occur within the potentially affected area of the proposed Brenda SEZ. Wildlife
5 known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from
6 Arizona Field Ornithologists (2010), Brennan (2008), Hoffmeister (1986), and SWReGAP
7 (USGS 2007). Land cover types suitable for each species were determined from SWReGAP
8 (USGS 2004, 2005a, 2007). The amount of aquatic habitat within the SEZ region was
9 determined by estimating the length of linear perennial stream features and the area of standing
10 water body features (i.e., ponds, lakes, and reservoirs) within 50 mi (80 km) of the SEZ using
11 available GIS surface water datasets.

12
13 The affected area considered in this assessment included the areas of direct and indirect
14 effects. The area of direct effects was defined as the area that would be physically modified
15 during project development (i.e., where ground-disturbing activities would occur) and included
16 the SEZ and a 250-ft (76-m) wide portion of an assumed 19-mi (31-km) long transmission line
17 corridor. The maximum developed area within the SEZ would be 3,102 acres (12.6 km²) and
18 the maximum developed area within the transmission line would be 576 acres (2.3 km²).

19
20 The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ
21 boundary and within the 1.0-mi (1.6-km) wide assumed transmission line corridor where ground-
22 disturbing activities would not occur, but that could be indirectly affected by activities in the area
23 of direct effect (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or road
24 construction area). If a species' potentially suitable habitat within the SEZ was greater than the
25 maximum of 3,102 acres (12.6 km²) of direct effect, it was also included as part of the area of
26 indirect effects. The potential degree of indirect effects would decrease with increasing distance
27 from the SEZ. The area of indirect effect was identified on the basis of professional judgment
28 and was considered sufficiently large to bound the area that would potentially be subject to
29 indirect effects. These areas of direct and indirect effect are defined and the impact assessment
30 approach is described in Appendix M.

31
32 The primary land cover habitat type within the affected area is Sonora-Mojave creosote
33 desert scrub (see Section 8.1.10). Potentially unique habitats in the affected area include desert
34 washes and associated riparian habitats. The only potential aquatic habitat known to occur in
35 the SEZ is Bouse Wash, an intermittent streambed that exists along the easternmost boundary
36 of the SEZ. The only other aquatic habitat within the affected area is Tyson Wash, west of the
37 SEZ, in the assumed transmission line corridor. Other washes, Colorado River, Colorado River
38 Aqueduct, Bill Williams River, Alamo Lake, Copper Basin Reservoir, and Gene Wash Reservoir
39 occur within the SEZ region (Figure 8.1.9.1-1).

1 **8.1.11.1 Amphibians and Reptiles**

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3
4 **8.1.11.1.1 Affected Environment**

5
6 This section addresses amphibian and reptile species that are known to occur, or for
7 which potentially suitable habitat occurs, on or within the potentially affected area of the
8 proposed Brenda SEZ. The list of amphibian and reptile species potentially present in the SEZ
9 area was determined from species lists available from Brennan (2008) and range maps and
10 habitat information available from SWReGAP (USGS 2007). Land cover types suitable for each
11 species were determined from SWReGAP (USGS 2004, 2005a, 2007). See Appendix M for
12 additional information on the approach used.

13
14 Based on species distributions within the area of the SEZ and habitat preferences of
15 the amphibian species, the Great Basin spadefoot (*Spea intermontana*) and red-spotted toad
16 (*Bufo punctatus*) would be expected to occur within the SEZ (Brennan 2008; USGS 2007;
17 Stebbins 2003). They would most likely occur in the portion of the SEZ that overlaps the
18 Bouse Wash and within the portion of the assumed transmission line corridor that encompasses
19 Tyson Wash.

20
21 More than 25 reptile species occur within the area that encompasses the proposed Brenda
22 SEZ (Brennan 2008; USGS 2007; Stebbins 2003). The desert tortoise (*Gopherus agassizii*) is a
23 federal and state listed threatened species and is discussed in Section 8.1.12. Lizard species
24 expected to occur within the SEZ include the desert horned lizard (*Phrynosoma platyrhinos*),
25 Great Basin collared lizard (*Crotaphytus bicinctores*), side-blotched lizard (*Uta stansburiana*),
26 western whiptail (*Cnemidophorus tigris*), and zebra-tailed lizard (*Callisaurus draconoides*).

27
28 Snake species expected to occur within the SEZ include the coachwhip (*Masticophis*
29 *flagellum*), common kingsnake (*Lampropeltis gentula*), glossy snake (*Arizona elegans*),
30 gophersnake (*Pituophis catenifer*), groundsnake (*Sonora semiannulata*), and nightsnake
31 (*Hypsiglena torquata*). The Mohave rattlesnake (*Crotalus scutulatus*), sidewinder (*C. cerastes*)
32 and western diamond-backed rattlesnake (*C. atrox*) would be the most common poisonous
33 snake species expected to occur on the SEZ.

34
35 Table 8.1.11.1-1 provides habitat information for representative amphibian and reptile
36 species that could occur within the proposed Brenda SEZ.

37
38
39 **8.1.11.1.2 Impacts**

40
41 The types of impacts that amphibians and reptiles could incur from construction,
42 operation, and decommissioning of utility-scale solar energy facilities are discussed in
43 Section 5.10.2.1. Any such impacts would be minimized through the implementation of required
44 programmatic design features described in Appendix A, Section A.2.2, and through additional
45 mitigation applied. Section 8.1.11.1.3, below, identifies SEZ-specific design features of
46 particular relevance to the proposed Brenda SEZ.

TABLE 8.1.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur on or in the Affected Area of the Proposed Brenda SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Amphibians					
Great Basin spadefoot (<i>Spea intermontana</i>)	Sagebrush flats, semi-desert shrublands, pinyon-juniper woodlands, and spruce-fir forests. Breeds in temporary and permanent waters including rain pools, pools in intermittent streams, and flooded areas along streams. About 2,091,500 acres ^h of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	60,010 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (<0.009% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. Avoid wash habitats.
Red-spotted toad (<i>Bufo punctatus</i>)	Dry, rocky areas at lower elevations near desert springs and persistent pools along rocky arroyos, desert streams and oases, open grassland, scrubland oaks, and dry woodlands. About 4,251,700 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,353 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats.
Lizards					
Desert horned lizard (<i>Phrynosoma platyrhinos</i>)	Deserts dominated by sagebrush, creosotebush, greasewood, or cactus. Occurs on sandy flats, alluvial fans, washes, and edges of dunes. Burrows in soil during periods of inactivity. About 4,261,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Lizards (Cont.)					
Great Basin collared lizard (<i>Crotaphytus bicinctores</i>)	Usually inhabits alluvia, lava flows, mountain slopes, canyons, buttes, rock outcrops, washes, and rocky plains. Limiting factors are the presence of large boulders and open/sparse vegetation. About 4,245,500 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,353 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Side-blotched lizard (<i>Uta stansburiana</i>)	Low to moderate elevations in washes, arroyos, boulder-strewn ravines, rocky cliff bases, and flat shrubby areas in canyon bottoms. Often along sandy washes. Usually in areas with a lot of bare ground. About 4,185,400 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Western whiptail (<i>Cnemidophorus tigris</i>)	Arid and semiarid habitats with sparse plant cover. About 4,269,000 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,822 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Lizards (Cont.)					
Zebra-tailed lizard (<i>Callisaurus draconoides</i>)	Open, warm-desert habitats, especially dry washes and canyons with fine gravel and sand. About 4,206,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid washes. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Snakes					
Coachwhip (<i>Masticophis flagellum</i>)	Creosotebush desert, shortgrass prairie, shrub-covered flats and hills. Sandy to rocky substrates. Avoids dense vegetation. About 4,183,600 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Common kingsnake (<i>Lampropeltis getula</i>)	Coniferous forests, woodlands, swampland, coastal marshes, river bottoms, farmlands, prairies, chaparral, and deserts. Uses rock outcrops and rodent burrows for cover. About 4,494,900 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,452 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Snakes (Cont.)					
Glossy snake (<i>Arizona elegans</i>)	Light shrubby to barren deserts, sagebrush flats, grasslands, and chaparral-covered slopes and woodlands. Prefers sandy grasslands, shrublands, and woodlands. About 4,190,400 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,820 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Gophersnake (<i>Pituophis catenifer</i>)	Arid and semiarid regions with rocky to sandy soils. River bottoms, desert flats, sand hummocks, and rocky hillsides. About 4,508,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,743 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	5238 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Groundsnake (<i>Sonora semiannulata</i>)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semi-desert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 4,260,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,822 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Snakes (Cont.)					
Mohave rattlesnake (<i>Crotalus scutulatus</i>)	Upland desert and lower mountain slopes including barren desert, grassland, open juniper woodland, and scrubland. Especially common in areas of scattered scrubby growth such as creosote and mesquite. About 4,542,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,881 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	5238 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Nightsnake (<i>Hypsiglena torquata</i>)	Arid and semiarid desert flats, plains, and woodlands; areas with rocky and sandy soils are preferred. During cold periods of the year, it seeks refuge underground, in crevices, or under rocks. About 4,190,700 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Sidewinder (<i>Crotalus cerastes</i>)	Windblown sand habitats near rodent burrows. Most common in areas of sand hummocks topped with creosote, mesquite, or other desert plants. About 4,183,800 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,814 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Snakes (Cont.)					
Western diamond-backed rattlesnake (<i>Crotalus atrox</i>)	Dry and semi-dry lowland areas. Usually found in brush-covered plains, dry washes, rock outcrops, and desert foothills. About 4,498,200 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,452 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

- ^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- ^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 3,102 acres of direct effect within the SEZ was assumed.
- ^c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- ^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 3,102 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.
- ^e For transmission line development, direct effects were estimated within a 19-mi (31-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.1.11.1-1 (Cont.)

^f Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

^g Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

^h To convert acres to km^2 , multiply by 0.004047.

Sources: Brennan (2008); CDFG (2008); NatureServe (2010); USGS (2004, 2005a, 2007).

1 The assessment of impacts on amphibian and reptile species is based on available
2 information on the presence of species in the affected area as presented in Section 8.1.11.1.1
3 following the analysis approach described in Appendix M. Additional NEPA assessments and
4 coordination with state natural resource agencies may be needed to address project-specific
5 impacts more thoroughly. These assessments and consultations could result in additional
6 required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 8.1.11.1.3).

7
8 In general, impacts on amphibians and reptiles would result from habitat disturbance
9 (i.e., habitat reduction, fragmentation, and alteration) and from disturbance, injury, or mortality
10 to individual amphibians and reptiles. On the basis of the magnitude of impacts on amphibians
11 and reptiles summarized in Table 8.1.11.1-1, direct impacts on representative amphibian and
12 reptile species would be small, ranging from a high of 0.2% for the Great Basin spadefoot to
13 only 0.07% for all other species (Table 8.1.11.1-1). Larger areas of potentially suitable habitats
14 for the amphibian and reptile species occur within the area of potential indirect effects (e.g., up
15 to 2.9% of available habitat for the Great Basin spadefoot and 2.1 to 2.2% for all other species).
16 Indirect impacts on amphibians and reptiles could result from surface water and sediment runoff
17 from disturbed areas, fugitive dust generated by project activities, accidental spills, collection,
18 and harassment. These indirect impacts are expected to be negligible with implementation of
19 programmatic design features.

20
21 Decommissioning after operations cease could result in short-term negative impacts on
22 individuals and habitats within and adjacent to the SEZ. The negative impacts of
23 decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term
24 benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4
25 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of
26 particular importance for amphibian and reptile species would be the restoration of original
27 ground surface contours, soils, and native plant communities associated with desert scrub, playa,
28 and wash habitats.

31 ***8.1.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness***

32
33 The implementation of required programmatic design features described in Appendix A,
34 Section A.2.2, would reduce the potential for effects on amphibians and reptiles, especially for
35 those species that utilize habitat types that can be avoided (e.g., washes). Indirect impacts could
36 be reduced to negligible levels by implementing programmatic design features, especially those
37 engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While
38 SEZ-specific design features are best established when considering specific project details, two
39 design features can be identified at this time:

- 40
- 41 • Bouse Wash should be avoided.
- 42
- 43 • Tyson Wash should be spanned by the transmission line.
- 44

45 If these SEZ-specific design features are implemented in addition to other programmatic
46 design features, impacts on amphibian and reptile species could be reduced. However, as

1 potentially suitable habitats for all of the representative amphibian and reptile species occur
2 throughout much of the SEZ, additional species-specific mitigation of direct effects for those
3 species would be difficult or infeasible.

4 5 6 **8.1.11.2 Birds**

7 8 9 **8.1.11.2.1 Affected Environment**

10 This section addresses bird species that
11 are known to occur, or for which potentially
12 suitable habitat occurs, on or within the
13 potentially affected area of the proposed Brenda
14 SEZ. The list of bird species potentially present
15 in the SEZ area was determined from the
16 Arizona Field Ornithologists (2010) and range
17 maps and habitat information available from
18 SWReGAP (USGS 2007). Land cover types suitable for each species were determined from
19 SWReGAP (USGS 2004, 2005a, 2007). See Appendix M for additional information on the
20 approach used.
21

Desert Focal Bird Species

Bird species whose requirements define spatial attributes, habitat characteristics, and management regimes representative of a healthy desert system (Chase and Geupel 2005).

22
23 Twelve of the bird species that could occur on or in the affected area of the SEZ are
24 considered focal species in the *Desert Bird Conservation Plan* (CalPIF 2009): ash-throated
25 flycatcher (*Myiarchus cinerascens*), black-tailed gnatcatcher (*Polioptila melanura*), black-
26 throated sparrow (*Amphispiza bilineata*), burrowing owl (*Athene cunicularia*), common raven
27 (*Corvus corax*), Costa's hummingbird (*Calypte costae*), Gila woodpecker (*Melanerpes*
28 *uropygialis*), ladder-backed woodpecker (*Picoides scalaris*), Le Conte's thrasher (*Toxostoma*
29 *lecontei*), Lucy's warbler (*Vermivora luciae*), phainopepla (*Phainopepla nitens*), and verdin
30 (*Auriparus flaviceps*). Habitats for most of these species are described in Table 8.1.11.2-1.
31 Because of its special species status, the burrowing owl is discussed in Section 8.1.12.1.
32

33 34 **Waterfowl, Wading Birds, and Shorebirds**

35
36 As discussed in Section 4.10.2.2.2, waterfowl (ducks, geese, and swans), wading birds
37 (herons and cranes), and shorebirds (avocets, gulls, plovers, rails, sandpipers, stilts, and terns)
38 are among the most abundant groups of birds in the six-state solar study area. However, within
39 the proposed Brenda SEZ, waterfowl, wading birds, and shorebird species would be mostly
40 absent to uncommon. Within the SEZ, Bouse Wash may attract shorebird species, but the
41 Colorado River, Colorado River Aqueduct, Bill Williams River, Alamo Lake, Copper Basin
42 Reservoir, and Gene Wash Reservoir, which occur within the 50-mi (80-km) SEZ region, would
43 provide more viable habitat for this group of birds. The killdeer (*Charadrius vociferus*) is the
44 shorebird species most likely to occur within the SEZ.

TABLE 8.1.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Brenda SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Shorebirds					
Killdeer (<i>Charadrius vociferus</i>)	Open areas such as fields, meadows, lawns, mudflats, and shores. Nests on ground in open dry or gravelly locations. About 247,100 acres ^h of potentially suitable habitat occurs within the SEZ region.	12 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) during construction and operations	8,368 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	48 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) and 966 acres in area of indirect effect	Small overall impact. Avoid wash habitats. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Neotropical Migrants					
Ash-throated flycatcher (<i>Myiarchus cinerascens</i>)	Common in scrub and woodland habitats, including desert riparian and desert washes. Requires hole/cavity for nesting. Uses shrubs or small trees for foraging perches. About 4,276,900 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Neotropical Migrants</i> (Cont.)					
Black-tailed gnatcatcher (<i>Poliopitila melanura</i>)	Nests in bushes mainly in wooded desert washes with dense mesquite, palo verde, ironwood, and acacia. Also occurs in desert scrub habitat. About 4,200,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,846 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Black-throated sparrow (<i>Amphispiza bilineata</i>)	Chaparral and desert scrub habitats with sparse to open stands of shrubs. Often in areas with scattered Joshua trees. Nests in thorny shrubs or cactus. About 4,198,600 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,820 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	43 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Brewer's sparrow (<i>Spizella breweri</i>)	Common in Mojave and Colorado Deserts during winter. Occupies open desert scrub and cropland habitats. About 2,073,300 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.15% of available potentially suitable habitat) during construction and operations	59,462 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	177 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,561 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Cactus wren (<i>Campylorhynchus brunneicapillus</i>)	Desert (especially areas with cholla cactus or yucca), mesquite, arid scrub, coastal sage scrub, and trees in towns in arid regions. Nests in <i>Opuntia</i> spp.; twiggy, thorny trees and shrubs; and sometimes in buildings. Nests may be used as winter roost. About 2,193,200 acres of potentially suitable habitat occurs within the SEZ region.	428 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	30,926 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Common poorwill (<i>Phalaenoptilus nuttallii</i>)	Scrubby and brushy areas, prairie, desert, rocky canyons, open woodlands, and broken forests. Mostly in arid and semiarid habitats. Nests in open areas on a bare site. About 4,203,500 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,355 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Common raven (<i>Corvus corax</i>)	Occurs in most habitats. Trees and cliffs provide cover. Roosts primarily in trees. Nests on cliffs, bluffs, tall trees, or man-made structures. Forages in sparse, open terrain. About 4,506,300 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,743 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	572 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,507 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Neotropical Migrants</i> (Cont.)					
Costa's hummingbird (<i>Calypte costae</i>)	Desert and semidesert areas, arid brushy foothills, and chaparral. Main habitats are desert washes, edges of desert riparian and valley foothill riparian areas, coastal shrub, desert scrub, desert succulent shrub, lower-elevation chaparral, and palm oasis. Also in mountains, meadows, and gardens during migration and winter. Most common in canyons and washes when nesting. Nests are located in trees, shrubs, vines, or cacti. About 4,269,800 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Gila woodpecker (<i>Melanerpes uropygialis</i>)	Prefers sparsely covered desert habitats containing large saguaro cacti. About 2,215,000 acres of potentially suitable habitat occurs within the SEZ region.	428 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	32,251 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	394 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) and 7,926 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Greater roadrunner (<i>Geococcyx californianus</i>)	Desert scrub, chaparral, edges of cultivated lands, and arid open areas with scattered brush. Requires thickets, large bushes, or small trees for shade, refuge, and roosting. Usually nests low in trees, shrubs, or clumps of cactus. Rarely nests on ground. About 4,489,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,450 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Horned lark (<i>Eremophila alpestris</i>)	Common to abundant resident in a variety of open habitats. Breeds in grasslands, sagebrush, semidesert shrublands, and alpine tundra. During migration and winter, inhabits the same habitats other than tundra, and occurs in agricultural areas. Usually occurs where plant density is low and there are exposed soils. About 2,294,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	67,202 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Neotropical Migrants</i> (Cont.)					
Ladder-backed woodpecker (<i>Picooides scalaris</i>)	Fairly common in Mojave and Colorado Deserts. Variety of habitats, including deserts, arid scrub, riparian woodlands, mesquite, scrub oak, pinyon-juniper woodlands. Digs nest hole in rotted stub or dead or dying branches of various trees. Also nests in saguaro, agave, yucca, fence posts, and utility poles. Nests on ledges; branches of trees, shrubs, and cactus; and holes in trees or walls. About 4,276,900 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Le Conte's thrasher (<i>Toxostoma leconteii</i>)	Open desert wash, alkali desert scrub, and desert succulent shrub habitats. Prefers to nest and forage in arroyos and washes lined with dense stands of creosotebush and salt bush. About 4,190,400 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,820 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Lesser nighthawk (<i>Chordeiles acutipennis</i>)	Open country, desert regions, scrub, savanna, and cultivated areas. Usually near water, including open marshes, salt ponds, large rivers, rice paddies, and beaches. Roosts on low perches or the ground. Nests in the open on bare sites. About 4,265,700 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,361 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Open country with scattered trees and shrubs, savanna, desert scrub, desert riparian, Joshua tree, and occasionally, open woodland habitats. Perches on poles, wires, or fence posts (suitable hunting perches are an important aspect of habitat). Nests in shrubs and small trees. About 4,507,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,478 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Lucy's warbler (<i>Vermivora luciae</i>)	Breeds most often in dense lowland riparian mesquite woodlands. Inhabits dry washes, riparian forests, and thorn forests during winter and migration. About 2,151,500 acres of potentially suitable habitat occurs within the SEZ region.	428 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	30,960 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact. Avoid wash habitats. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Phainopepla (<i>Phainopepla nitens</i>)	Common in Mojave and Colorado deserts. Desert scrub, mesquite, juniper and oak woodlands, tall brush, washes, riparian woodlands, and orchards. Nests in dense foliage of large shrubs or trees, sometimes in a clump of mistletoe. About 2,376,700 acres of potentially suitable habitat occurs in the SEZ region.	440 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	38,037 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact. Avoid wash habitats. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Say's phoebe (<i>Sayornis saya</i>)	Arid open country, deserts, sagebrush plains, dry barren foothills, canyons, cliffs, ranches, and rural homes. Nests in cliff crevices, holes in banks, sheltered ledges, tree cavities, under bridges and roofs, and in mines. About 2,289,000 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	67,091 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (0.0081% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. No mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Verdin (<i>Auriparus flaviceps</i>)	Desert riparian, desert wash, desert scrub, and alkali desert scrub areas with large shrubs and small trees. Nests in shrubs, small trees, or cactus. About 4,419,600 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,911 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Birds of Prey					
American kestrel (<i>Falco sparverius</i>)	Occurs in most open habitats, in various shrub and early successional forest habitats, forest openings, and various ecotones. Perches on trees, snags, rocks, utility poles and wires, and fence posts. Uses cavities in trees, snags, rock areas, banks, and buildings for nesting and cover. About 2,439,400 acres of potentially suitable habitat occurs in the SEZ region.	448 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	39,835 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	394 acres of potentially suitable habitat lost (0.016% of available potentially suitable habitat) and 7,926 acres in area of indirect effect	Small overall impact.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Birds of Prey (Cont.)					
Golden eagle (<i>Aquila chrysaetos</i>)	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and in winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 2,428,000 acres of potentially suitable habitat occurs in the SEZ region.	448 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	38,544 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.
Prairie falcon (<i>Falco mexicanus</i>)	Open habitats adjacent to cliffs or bluffs. Occurs mainly in desert grassland, chaparral, and creosotebush-bursage habitats. About 4,542,000 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,881 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	574 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,548 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Red-tailed hawk (<i>Buteo jamaicensis</i>)	Wide variety of habitats from deserts, mountains, and populated valleys. Open areas with scattered, elevated perch sites, such as scrub desert, plains and montane grassland, agricultural fields, pastures, urban parklands, broken coniferous forests, and deciduous woodland. Nests on cliff ledges or in tall trees. About 2,410,400 acres of potentially suitable habitat occurs in the SEZ region.	448 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	38,534 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Birds of Prey (Cont.)					
Turkey vulture (<i>Cathartes aura</i>)	Occurs in open stages of most habitats that provide adequate cliffs or large trees for nesting, roosting, and resting. Migrates and forages over most open habitats. Will roost communally in trees, exposed boulders, and occasionally on transmission line support towers. About 2,316,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	67,127 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Upland Game Birds					
Gambel's quail (<i>Callipepla gambelii</i>)	Deserts, especially in areas with brushy or thorny growth, and adjacent cultivated areas. Usually occurs near water. Nests on the ground under cover of small trees, shrubs, and grass tufts. About 4,286,600 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,389 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Mourning dove (<i>Zenaida macroura</i>)	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, deserts, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 4,517,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,387 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Upland Game Birds</i> (Cont.)					
White-winged dove (<i>Zenaida asiatica</i>)	Nests in low to medium height trees with dense foliage and fairly open ground cover. Feeds on wild seeds, grains, and fruit. About 4,268,300 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,387 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 13,242 acres of direct effect within the SEZ was assumed.

^c Direct effects within the SEZ consist of the ground-disturbing activities associated with the construction and maintenance of an altered environment associated with operations.

^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 3,102 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

^e For transmission line development, direct effects were estimated within a 19-mi (31-km) long, 250-ft (76-m) wide access road ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.1.11.2-1 (Cont.)

- ^f Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^g Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ^h To convert acres to km^2 , multiply by 0.004047.

Sources: Arizona Field Ornithologists (2010); CalPIF (2009); CDFG (2008); NatureServe (2010); USGS (2004, 2005a, 2007).

Neotropical Migrants

As discussed in Section 4.10.2.2.3, neotropical migrants represent the most diverse category of birds within the six-state solar energy study area. Species expected to occur within the proposed Brenda SEZ include the ash-throated flycatcher, black-tailed gnatcatcher, black-throated sparrow, Brewer's sparrow (*Spizella breweri*), cactus wren (*Campylorhynchus brunneicapillus*), common poorwill (*Phalaenoptilus nuttallii*), common raven, Costa's hummingbird, Gila woodpecker, greater roadrunner (*Geococcyx californianus*), horned lark (*Eremophila alpestris*), ladder-backed woodpecker, Le Conte's thrasher, lesser nighthawk (*Chordeiles acutipennis*), loggerhead shrike (*Lanius ludovicianus*), Lucy's warbler, phainopepla, Say's phoebe (*Sayornis saya*), and verdin (Arizona Field Ornithologists 2010; CalPIF 2009; USGS 2007).

Birds of Prey

Section 4.10.2.2.4 provided an overview of the birds of prey (raptors, owls, and vultures) within the six-state solar study area. Raptor species that could occur within the proposed Brenda SEZ include the American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), and turkey vulture (*Cathartes aura*) (Arizona Field Ornithologists 2010; USGS 2007). Several other special status birds of prey are discussed in Section 8.1.12. These include the American peregrine falcon (*Falco peregrinus anatum*), bald eagle (*Haliaeetus leucocephalus*), ferruginous hawk (*Buteo regalis*), long-eared owl (*Asio otus*), and burrowing owl.

Upland Game Birds

Section 4.10.2.2.5 provided an overview of the upland game birds (primarily pheasants, grouse, quail, and doves) that occur within the six-state solar study area. Upland game species that could occur within the proposed Brenda SEZ include Gambel's quail (*Callipepla gambelii*), mourning dove (*Zenaida macroura*), and white-winged dove (*Zenaida asiatica*) (Arizona Field Ornithologists 2010; USGS 2007).

8.1.11.2.2 Impacts

The types of impacts birds could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 8.1.11.2.3, below, identifies design features of particular relevance to the proposed Brenda SEZ.

The assessment of impacts on bird species is based on available information on the presence of species in the affected area as presented in Section 8.1.11.2.1 following the analysis

1 approach described in Appendix M. Additional NEPA assessments and coordination with federal
2 or state natural resource agencies may be needed to address project-specific impacts more
3 thoroughly. These assessments and consultations could result in additional required actions to
4 avoid or mitigate impacts on birds (see Section 8.1.11.2.3).

5
6 In general, impacts on birds would result from habitat disturbance (i.e., habitat reduction,
7 fragmentation, and alteration), and from disturbance, injury, or mortality to individual birds.
8 Table 8.1.11.2-1 summarizes the magnitude of potential impacts on representative bird species
9 resulting from solar energy development in the proposed Brenda SEZ. On the basis of the
10 impacts on birds summarized in Table 8.1.11.2-1, direct impacts on representative bird species
11 would be small for all bird species (ranging from a high of 0.15% for Brewer's sparrow to a low
12 of 0.005% for the killdeer [Table 8.1.11.2-1]). Larger areas of potentially suitable habitats for
13 bird species occur within the area of potential indirect effects (e.g., up to 3.4% of available
14 habitat for the killdeer). Indirect impacts on birds could result from surface water and sediment
15 runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and
16 harassment. These indirect impacts are expected to be negligible with implementation of
17 programmatic design features.

18
19 Decommissioning after operations cease could result in short-term negative impacts on
20 individuals and habitats within and adjacent to the SEZ. The negative impacts of
21 decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term
22 benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4
23 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of
24 particular importance for bird species would be the restoration of original ground surface
25 contours, soils, and native plant communities associated with desert scrub, playa, and wash
26 habitats.

27 28 29 ***8.1.11.2.3 SEZ-Specific Design Features and Design Feature Effectiveness***

30
31 The successful implementation of programmatic design features presented in
32 Appendix A, Section A.2.2, would reduce the potential for effects on birds, especially for those
33 species that depend on habitat types that can be avoided (e.g., wash habitats). Indirect impacts
34 could be reduced to negligible levels by implementing programmatic design features, especially
35 those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust.
36 While SEZ-specific design features that are important for reducing impacts on birds are best
37 established when considering specific project details, some design features can be identified at
38 this time:

- 39
40 • For solar energy developments within the SEZ, the requirements contained
41 within the 2010 Memorandum of Understanding between the BLM and
42 USFWS to promote the conservation of migratory birds will be followed.
- 43
44 • Take of golden eagles and other raptors should be avoided. Mitigation
45 regarding the golden eagle should be developed in consultation with the

1 USFWS and the Arizona Game and Fish Department. A permit may be
2 required under the Bald and Golden Eagle Protection Act.

- 3
4 • Bouse Wash and Tyson Wash, which could provide occasional watering and feeding
5 sites for some bird species, should be avoided by solar energy development or
6 spanned by transmission line development.
7

8 If the SEZ-specific design features are implemented in addition to programmatic design
9 features, impacts on bird species could be reduced. However, as potentially suitable habitats for
10 most of the bird species occur throughout much of the SEZ, additional species-specific
11 mitigation of direct effects for those species would be difficult or infeasible.
12

13 **8.1.11.3 Mammals**

14 **8.1.11.3.1 Affected Environment**

15
16
17
18
19 This section addresses mammal species that are known to occur, or for which potentially
20 suitable habitat occurs, on or within the potentially affected area of the proposed Brenda SEZ.
21 The list of mammal species potentially present in the SEZ area was determined from Hoffmeister
22 (1986) and range maps and habitat information available from SWReGAP (USGS 2007). Land
23 cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a,
24 2007). See Appendix M for additional information on the approach used. About 45 species of
25 mammals have ranges that encompass the area of the proposed Brenda SEZ (Hoffmeister 1986;
26 USGS 2007); however, suitable habitats for a number of these species are limited or nonexistent
27 within the SEZ (USGS 2007). Similar to the overview of mammals provided for the six-state
28 solar energy study area (Section 4.10.2.3), the following discussion for the SEZ emphasizes big
29 game and other mammal species that (1) have key habitats within or near the SEZ, (2) are
30 important to humans (e.g., big game, small game, and furbearer species), and/or (3) are
31 representative of other species that share important habitats.
32

33 **Big Game**

34
35
36 The big game species that could occur within the affected area of the proposed Brenda
37 SEZ include cougar (*Puma concolor*), mule deer (*Odocoileus hemionus*), and Nelson's bighorn
38 sheep (*Ovis canadensis nelsoni*) (Hoffmeister 1986; USGS 2007). Due to its special species
39 status, the Nelson's bighorn sheep is addressed in Section 8.1.12.
40

41 **Other Mammals**

42
43
44 A number of small game and furbearer species occur within the area of the proposed
45 Brenda SEZ. Species that could occur within the area of the Brenda SEZ would include the
46 American badger (*Taxidea taxus*), black-tailed jackrabbit (*Lepus californicus*), bobcat (*Lynx*

1 *rufus*), coyote (*Canis latrans*, common), desert cottontail (*Sylvilagus audubonii*), gray fox
2 (*Urocyon cinereoargenteus*), javelina or spotted peccary (*Pecari tajacu*), kit fox (*Vulpes*
3 *macrotis*), ringtail (*Bassariscus astutus*), and striped skunk (*Mephitis mephitis*) (USGS 2007).
4

5 Nongame mammal (small) species generally include smaller mammals such as rodents,
6 bats, and shrews. Species for which potentially suitable habitat occurs within the SEZ include the
7 Arizona pocket mouse (*Perognathus amplus*), Botta's pocket gopher (*Thomomys bottae*), cactus
8 mouse (*Peromyscus eremicus*), canyon mouse (*P. crinitis*), deer mouse (*P. maniculatus*), desert
9 pocket mouse (*Chaetodipus penicillatus*), desert shrew (*Notiosorex crawfordi*), desert woodrat
10 (*Neotoma lepida*), Merriam's pocket mouse (*Dipodomys merriami*), round-tailed ground squirrel
11 (*Spermophilus tereticaudus*), southern grasshopper mouse (*Onychomys torridus*), and white-
12 tailed antelope squirrel (*Ammospermophilus leucurus*) (Hoffmeister 1986; USGS 2007). Bat
13 species that may occur within the area of the SEZ include the big brown bat (*Eptesicus fuscus*),
14 Brazilian free-tailed bat (*Tadarida brasiliensis*), California myotis (*Myotis californicus*), silver-
15 haired bat (*Lasionycteris noctivagans*), spotted bat (*Euderma maculatum*), and western
16 pipistrelle (*Pipistrellus hesperus*) (Hoffmeister 1986; USGS 2007). However, roost sites for the
17 bat species (e.g., caves, hollow trees, rock crevices, or buildings) would be limited, to absent,
18 within the SEZ. Several other special status bat species that could occur within the SEZ area are
19 addressed in Section 8.1.12.1.
20

21 Table 8.1.11.3-1 provides habitat information for representative mammal species that
22 could occur within the proposed Brenda SEZ.
23
24

25 **8.1.11.3.2 Impacts**

26

27 The types of impacts that mammals could incur from construction, operation, and
28 decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any
29 such impacts would be minimized through the implementation of required programmatic design
30 features described in Appendix A, Section A.2.2, and through any additional mitigation applied.
31 Section 8.1.11.3.3, below, identifies design features of particular relevance to mammals for the
32 proposed Brenda SEZ.
33

34 The assessment of impacts on mammal species is based on available information on the
35 presence of species in the affected area as presented in Section 8.1.11.3.1 following the analysis
36 approach described in Appendix M. Additional NEPA assessments and coordination with state
37 natural resource agencies may be needed to address project-specific impacts more thoroughly.
38 These assessments and consultations could result in additional required actions to avoid or
39 mitigate impacts on mammals (see Section 8.1.11.3.3).
40

41 Table 8.1.11.3-1 summarizes the magnitude of potential impacts on select mammal
42 species resulting from solar energy development (with the inclusion of programmatic design
43 features) in the proposed Brenda SEZ.
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TABLE 8.1.11.3-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed Brenda SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Big Game					
Cougar (<i>Puma concolor</i>)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. About 4,275,100 acres ^h of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Mule deer (<i>Odocoileus hemionus</i>)	Most habitats, including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provides abundant browse and cover. About 4,500,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,937 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Small Game and Furbearers					
American badger (<i>Taxidea taxus</i>)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Digs burrows in friable soils. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 4,199,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,822 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Small Game and Furbearers (Cont.)					
Black-tailed jackrabbit (<i>Lepus californicus</i>)	Open plains, fields, and deserts with scattered thickets or patches of shrubs. Also open, early stages of forests and chaparral habitats. Rests during the day in shallow depressions, and uses shrubs for cover. About 2,322,600 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	66,670 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	179 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 3,601 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Bobcat (<i>Lynx rufus</i>)	Most habitats, other than subalpine coniferous forest and montane meadow grasslands. Most common in rocky country from deserts through ponderosa forests. About 2,096,300 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	59,470 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Coyote (<i>Canis latrans</i>)	All habitats at all elevations. Least common in dense coniferous forest. Where human control efforts occur, they are restricted to broken, rough country with abundant shrub cover and a good supply of rabbits or rodents. About 4,517,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,879 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	574 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,548 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Small Game and Furbearers (Cont.)					
Desert cottontail (<i>Sylvilagus audubonii</i>)	Abundant, to common, in grasslands, open forests, and desert shrub habitats. Can occur in areas with minimal vegetation as long as adequate cover (e.g., rock piles, fallen logs, fence rows) is present. Thickets and patches of shrubs, vines, and brush are also used as cover. About 4,430,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,020 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	525 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,562 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Gray fox (<i>Urocyon cinereoargenteus</i>)	Deserts, open forests, and brush. Prefers wooded areas, broken country, brushlands, and rocky areas. Tolerant of low levels of residential development. About 4,418,400 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,909 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Javelina (spotted peccary) (<i>Pecari tajacu</i>)	Often in thickets along creeks and washes. Beds in caves, mines, boulder fields, and dense stands of brush. May visit a water hole on a daily basis. About 4,276,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Small Game and Furbearers (Cont.)					
Kit fox (<i>Vulpes macrotis</i>)	Desert and semidesert areas with relatively open vegetative cover and soft soils. Seeks shelter in underground burrows. About 4,257,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,353 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Ringtail (<i>Bassariscus astutus</i>)	Usually in rocky areas with cliffs or crevices for daytime shelter, desert scrub, chaparral, pine-oak and conifer woodlands. About 4,438,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,202 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	572 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,507 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Striped skunk (<i>Mephitis mephitis</i>)	Prefers semi-open country with woodland and meadows interspersed, brushy areas, bottomland woods. Frequently found in suburban areas. Dens often under rocks, logs, or buildings. About 4,426,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,903 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals</i>					
Arizona pocket mouse (<i>Perognathus amplus</i>)	Various desert scrub habitats. Sleeps and rears young in underground burrows. About 4,242,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Big brown bat (<i>Eptesicus fuscus</i>)	Most habitats from lowland deserts to timberline meadows. Roosts in hollow trees, rock crevices, mines, tunnels, and buildings. About 4,437,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,192 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	571 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,487 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Botta's pocket gopher (<i>Thomomys bottae</i>)	Variety of habitats, including shortgrass plains, oak savanna, agricultural lands, and deserts. Burrows are more common in disturbed areas such as roadways and stream floodplains. About 4,192,500 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Nongame (small)					
Mammals (Cont.)					
Brazilian free-tailed bat (<i>Tadarida brasiliensis</i>)	Cliffs, deserts, grasslands, old fields, savannas, shrublands, woodlands, and suburban/urban areas. Roosts in buildings, caves, and hollow trees. May roost in rock crevices, bridges, signs, or cliff swallow nests during migration. Large maternity colonies inhabit caves, buildings, culverts, and bridges. About 4,440,300 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,305 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	573 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,528 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Cactus mouse (<i>Peromyscus eremicus</i>)	Variety of areas, including desert scrub, semidesert chaparral, desert wash, semidesert grassland, and cliff and canyon habitats. About 4,279,500 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,882 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
California myotis (<i>Myotis californicus</i>)	Desertscrub, semidesert shrublands, lowland riparian, swamps, riparian suburban areas, plains grasslands, scrub-grasslands, woodlands, and forests. Roosts in caves, mine tunnels, hollow trees, and loose rocks. About 4,208,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,822 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
Nongame (small)					
Mammals (Cont.)					
Canyon mouse (<i>Peromyscus crinitus</i>)	Associated with rocky substrates in a variety of habitats, including desert scrub, sagebrush shrublands, woodlands, cliffs and canyons, and volcanic rock and cinder lands. Source of free water not required. About 4,259,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,355 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Deer mouse (<i>Peromyscus maniculatus</i>)	Tundra; alpine and subalpine grasslands; plains grasslands; open, sparsely vegetated deserts; warm temperate swamps and riparian forests; and Sonoran desert scrub habitats. About 4,417,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,903 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Desert pocket mouse (<i>Chaetodipus penicillatus</i>)	Sparsely vegetated sandy deserts. Prefers rock-free bottomland soils along rivers and streams. Sleeps and rears young in underground burrows. About 4,268,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,848 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals (Cont.)</i>					
Desert shrew (<i>Notiosorex crawfordi</i>)	Usually in arid areas with adequate cover such as semiarid grasslands, shortgrass plains, desert scrub, chaparral slopes, shortgrass plains, oak savannas and woodlands, and alluvial fans. About 4,497,500 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,478 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Desert woodrat (<i>Neotoma lepida</i>)	Sagebrush scrub; chaparral; deserts and rocky slopes with scattered cactus, yucca, pine-juniper, or other low vegetation; creosotebush desert; Joshua tree woodlands; scrub oak woodlands, pinyon-juniper woodlands; and riparian zones. Most abundant in rocky areas with Joshua trees. Dens built of debris on ground, among cacti or yucca, along cliffs, among rocks, or occasionally in trees. About 4,268,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals (Cont.)</i>					
Merriam's kangaroo rat <i>Dipodomys merriami</i>	Plains grasslands, scrub-grasslands, desertscrub, shortgrass plains, oak and juniper savannahs, mesquite dunes, and creosote flats. About 4,265,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,361 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Round-tailed ground squirrel <i>Spermophilus tereticaudus</i>	Low flat areas with desert shrubs and usually with sandy soils. Also in areas with coarse hard-packed sand and gravel, alkali sinks, and creosotebush communities. Burrows usually at base of shrubs. Avoids rocky hills. About 4,265,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Silver-haired bat <i>Lasionycteris noctivagans</i>	Urban areas, chaparral, alpine and subalpine grasslands, forests, scrub-grassland, oak savannah, and desertscrub habitats. Roosts under bark, and in hollow trees, caves, and mines. Forages over clearings and open water. About 2,107,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	60,754 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	226 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 4,567 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals (Cont.)</i>					
Southern grasshopper mouse (<i>Onychomys torridus</i>)	Low, arid, shrub and semiscrub vegetation of deserts. About 4,268,700 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,381 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Spotted bat (<i>Euderma maculatum</i>)	Various habitats from desert to montane coniferous forests, mostly in open or scrub areas. Roosts in caves and cracks and crevices in cliffs and canyons. About 2,150,600 acres of potentially suitable habitat occurs within the SEZ region	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	59,496 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Western pipistrelle (<i>Parastrellus hesperus</i>)	Deserts and lowlands, desert mountain ranges, desert scrub flats, and rocky canyons. Roosts mostly in rock crevices, sometimes mines and caves, and rarely in buildings. Suitable roosts occur in rocky canyons and cliffs. Most abundant bat in desert regions. About 4,206,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	92,214 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	573 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,568 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals (Cont.)</i>					
White-tailed antelope squirrel (<i>Ammospermophilus leucurus</i>)	Low deserts, semidesert and montane shrublands, plateaus, and foothills in areas with sparse vegetation and hard gravelly surfaces. Spends its nights and other periods of inactivity in underground burrows. About 4,184,400 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

- ^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- ^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 3,102 acres of direct effect within the SEZ was assumed.
- ^c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- ^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 3,102 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.
- ^e For transmission line development, direct effects were estimated within a 19-mi (31-km) long, 250-ft (76-m) wide access road ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.1.11.3-1 (Cont.)

^f Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

^g Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

^h To convert acres to km^2 , multiply by 0.004047.

Sources: CDFG (2008); Hoffmeister (1986); NatureServe (2010); USGS (2004, 2005a, 2007).

1
2

1 **Cougar**

2
3 Up to 3,102 acres (12.6 km²) of potentially suitable cougar habitat could be lost through
4 solar energy development within the proposed Brenda SEZ. An additional 523 acres (2.1 km²)
5 could be lost by transmission line development. Together, these represent about 0.08% of
6 potentially suitable cougar habitat within the SEZ region. Over 91,000 acres (368 km²) of
7 potentially suitable cougar habitat occurs within the area of indirect effect for the SEZ and
8 transmission line. This is about 2.1% of potentially suitable cougar habitat within the SEZ
9 region. Overall, impacts on cougar from solar energy development in the SEZ would be small.

10
11
12 **Mule Deer**

13
14 Up to 3,102 acres (12.6 km²) of potentially suitable mule deer habitat could be lost
15 through solar energy development within the proposed Brenda SEZ. An additional 523 acres
16 (2.1 km²) could be lost by transmission line development. Together, these represent about 0.08%
17 of potentially suitable mule deer habitat within the SEZ region. Over 97,900 acres (396 km²) of
18 potentially suitable mule deer habitat occurs within the area of indirect effect for the SEZ and
19 access road. This is about 2.2% of potentially suitable mule deer habitat within the SEZ region.
20 Overall, impacts on mule deer from solar energy development in the SEZ would be small.

21
22
23 **Other Mammals**

24
25 Direct impacts on all other representative mammal species from solar energy
26 development within the proposed Brenda SEZ would be small (Table 8.1.11.3-1). For all of these
27 species, up to 3,102 acres (12.6 km²) (0.07 to 0.1%) of potentially suitable habitat would be lost.
28 Direct impacts from transmission line development for these species would range from 178 to
29 574 acres (0.7 to 2.3 km²) (Table 8.1.11.3-1). Loss of potential habitat to transmission line
30 development would be no more than 0.01% of potentially suitable habitat within the SEZ region
31 for any of these species. Larger areas of potentially suitable habitats for these mammal species
32 occur within the area of potential indirect effects (i.e., from 2.1 to 2.9% of available habitat
33 [Table 8.1.11.3-1]).

34
35
36 **Summary**

37
38 Overall, impacts on mammal species would be small (Table 8.1.11.3-1). In addition to
39 habitat loss, other direct impacts on mammals could result from collision with vehicles and
40 infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and
41 sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental
42 spills, and harassment. These indirect impacts are expected to be negligible with implementation
43 of programmatic design features.

44
45 Decommissioning after operations cease could result in short-term negative impacts on
46 individuals and habitats within and adjacent to the SEZ. The negative impacts of

1 decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term
2 benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4
3 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of
4 particular importance for mammal species would be the restoration of original ground surface
5 contours, soils, and native plant communities associated with desert scrub, playa, and wash
6 habitats.

7 8 9 **8.1.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness**

10 The implementation of required programmatic design features described in Appendix A,
11 Section A.2.2, would reduce the potential for effects on mammals. While SEZ-specific design
12 features are best established when considering specific project details, design features that can be
13 identified at this time are:

- 14 • The fencing around the solar energy development should not block the free
15 movement of mammals, particularly big game species.
- 16 • Bouse Wash and Tyson Wash, which could provide occasional watering and
17 feeding sites for some bird species, should be avoided by solar energy
18 development or spanned by transmission line development, respectively.

19 If these SEZ-specific design features are implemented in addition to the programmatic
20 design features, impacts on mammals could be reduced. However, potentially suitable habitats
21 for a number of the mammal species occur throughout much of the SEZ; therefore, species-
22 specific mitigation of direct effects for those species would be difficult or infeasible.

23 24 25 26 27 28 29 **8.1.11.4 Aquatic Biota**

30 31 32 **8.1.11.4.1 Affected Environment**

33 The proposed Brenda SEZ is located in a semiarid desert valley where surface waters
34 are typically limited to intermittent washes that only contain water for short periods during or
35 following precipitation. No perennial streams, water bodies, seeps, or springs are present on
36 the proposed Brenda SEZ or within the area of the presumed new transmission line corridor.
37 Ephemeral streams may cross the SEZ, but these drainages only contain water following rainfall
38 and typically do not support wetland or riparian habitats. One mi (2 km) of Bouse Wash runs
39 through the eastern edge of the proposed Brenda SEZ. Bouse Wash is a typically dry intermittent
40 stream that is not expected to contain aquatic habitat. Although not considered aquatic habitat,
41 intermittent and ephemeral streams may contain seasonal populations of crustaceans and
42 terrestrial and aquatic insect larvae adapted to desiccation. These organisms may exist in a
43 dormant form even during dry conditions (Levick et al. 2008). More detailed site survey data are
44 needed to characterize the aquatic biota, if present.

1 No perennial streams, water bodies, seeps, or springs are present within the area of
2 indirect effects associated with the SEZ or the presumed new transmission line corridor, but 7 mi
3 (11 km) of Bouse Wash and 0.6 mi (1 km) of Tyson Wash are located within the area of indirect
4 effects associated with the SEZ and new transmission line corridor, respectively. Both streams
5 are intermittent and are not likely to contain aquatic habitat, but more detailed site survey data
6 are needed to characterize the aquatic biota, if present. Bouse Wash does not flow into any
7 perennial surface water, but Tyson Wash drains into the Colorado River.
8

9 Outside of the indirect effects area, but within 50 mi (80 km) of the proposed Brenda
10 SEZ, there are approximately 37 mi (59 km) of perennial streams, 494 mi (795 km) of
11 intermittent streams, and 23 mi (37 km) of man-made stream and aqueduct. Also present within
12 50 mi (80 km) of the SEZ is an additional 15,738 acres (64 km²) of lake-habitat, 809 acres
13 (3 km²) of reservoirs, and 44,606 acres (180 km²) of the Colorado River. However, these water
14 bodies are all more than 30 mi (48 km) from the proposed Brenda SEZ. Intermittent streams are
15 the only surface water feature in the area of direct and indirect effects, and their area represents
16 approximately 2% of the total amount of intermittent stream present in the 50-mi (80-km) SEZ
17 region.
18
19

20 **8.1.11.4.2 Impacts**

21

22 Because surface water habitats are a unique feature in the arid landscape in the vicinity
23 of the proposed Brenda SEZ, the maintenance and protection of such habitats may be important
24 to the survival of aquatic and terrestrial organisms. The types of impacts that aquatic habitats and
25 biota could incur from the development of utility-scale solar energy facilities are described in
26 detail in Section 5.10.3. Aquatic habitats present on or near the locations selected for
27 construction of solar energy facilities could be affected in a number of ways, including (1) direct
28 disturbance, (2) deposition of sediments, (3) changes in water quantity, and (4) degradation of
29 water quality.
30

31 There are no permanent water bodies, streams, or wetlands present within the boundaries
32 of either the proposed Brenda SEZ or the presumed new transmission line corridor, and
33 consequently there would be no direct impacts on aquatic habitats from solar energy
34 development. Intermittent streams are present in the area of direct and indirect effects, and
35 disturbance of land areas within the SEZ for solar energy facilities and the construction of a new
36 transmission line corridor could increase the transport of soil into these intermittent streams via
37 water- and airborne pathways. Although intermittent and ephemeral streams may contain aquatic
38 biota, these streams are typically dry and are not likely to support aquatic habitat or
39 communities. More detailed site surveys for biota in ephemeral and intermittent surface waters
40 would be necessary to determine whether solar energy development activities would result in
41 direct or indirect impacts to aquatic biota. The introduction of waterborne sediments to Bouse
42 Wash and Tyson Wash could be minimized using common mitigation measures such as settling
43 basins, silt fences, or directing water draining from the developed areas away from streams.
44 Bouse Wash does not connect to any permanent surface water features, but Tyson Wash flows
45 into the Colorado River. However, it is unlikely any of the sediment from surface runoff or

1 airborne dust associated with ground disturbance would reach aquatic habitat, given the large
2 distance from the SEZ and transmission line to the nearest perennial stream (30 mi [48 km]).
3

4 In arid environments, reductions in the quantity of water in aquatic habitats are of
5 particular concern. Water quantity in aquatic habitats could also be affected if significant
6 amounts of surface water or groundwater are utilized for power plant cooling water, for washing
7 mirrors, or for other needs. The greatest need for water would occur if technologies employing
8 wet cooling, such as parabolic trough or power tower, were developed at the site; the associated
9 impacts would ultimately depend on the water source used (including groundwater from aquifers
10 at various depths). There are no surface water habitats on the proposed Brenda SEZ that could be
11 used to supply water needs. Water demands during normal operations would most likely be met
12 by withdrawing groundwater from wells constructed on-site, potentially affecting water levels in
13 surface water features outside of the proposed SEZ and the area of indirect effects, and, as a
14 consequence, potentially reduce habitat size, connectivity, and create more adverse
15 environmental conditions for aquatic organisms in those habitats (Section 8.1.9). Additional
16 details regarding the volume of water required and the types of organisms present in potentially
17 affected water bodies would be required in order to further evaluate the potential for impacts
18 from water withdrawals.
19

20 As described in Section 5.10.2.4, water quality in aquatic habitats could be affected by
21 the introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during site
22 characterization, construction, operation, or decommissioning/reclamation of a solar energy
23 facility. There is the potential for runoff containing contaminants to enter Bouse Wash,
24 especially if construction occurs nearby. Bouse Wash is located within the SEZ; typically it is
25 dry and is not expected to contain aquatic habitat. However, aquatic biota may be present
26 seasonally, and they could be affected by contaminants. Because of the relatively large distance
27 from any permanent surface water features to solar development activities and transmission line
28 corridors, the potential for introducing contaminants into such water bodies would be small,
29 especially if the appropriate mitigation measures were used.
30

31 32 ***8.1.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness.*** 33

34 The implementation of required programmatic design features described in Appendix A,
35 Section A.2.2, would greatly reduce or eliminate the potential for effects on aquatic biota and
36 aquatic habitats from development and operation of solar energy facilities. While some SEZ-
37 specific design features are best established when specific project details are being considered, a
38 design feature that can be identified at this time is the following:
39

- 40 • All aquatic habitats within the SEZ (e.g., Bouse Wash) should be avoided to
41 the extent practicable.
42

43 If this SEZ-specific design feature is implemented in addition to programmatic design
44 features and if the utilization of water from groundwater or surface water sources is adequately
45 controlled to maintain sufficient water levels in aquatic habitats, the potential impacts on

1 aquatic biota and habitats from solar energy development in the proposed Brenda SEZ would
2 be negligible.
3
4

8.1.12 Special Status Species (Threatened, Endangered, Sensitive, and Rare Species)

This section addresses special status species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Brenda SEZ. Special status species include the following types of species³:

- Species listed as threatened or endangered under the Endangered Species Act (ESA);
- Species that are proposed for listing, under review, or are candidates for listing under the ESA;
- Species that are listed by the BLM as sensitive;
- Species that are listed by the State of Arizona⁴; and
- Species that have been ranked by the state of Nevada as S1 or S2, or species of concern by the USFWS; hereafter referred to as “rare” species.

Special status species known to occur within 50 mi (80 km) of the Brenda SEZ center (i.e., the SEZ region) were determined from natural heritage records available through NatureServe Explorer (NatureServe 2010) and information provided by the Arizona Natural Heritage Program (ANHP) (Schwartz 2009; ANHP 2010), California Regional Gap Analysis Project (CAREGAP) (USGS 2010d), Southwest Regional Gap Analysis Project (SWReGAP) (USGS 2004, 2005a, 2007), and USFWS Environmental Conservation Online System (ECOS) (USFWS 2010a). Information reviewed consisted of county-level occurrences as determined from NatureServe, quad-level occurrences provided by the ANHP, and modeled land cover types and predicted suitable habitats for the species within the 50 mi (80 km) region as determined from SWReGAP. The 50 mi (80 km) SEZ region intersects La Paz, Maricopa, Mohave, Yavapai, and Yuma Counties in Arizona, as well as Imperial, Riverside, and San Bernardino Counties in California. However, the SEZ (and affected area) occurs only in La Paz County, Arizona. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

8.1.12.1 Affected Environment

The affected area considered in our assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur). For the

³ See Section 4.6.4 for definitions of these species categories. Note that some of the categories of species included here do not fit BLM’s definition of special status species as defined in BLM Manual 6840 (BLM 2008c). These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

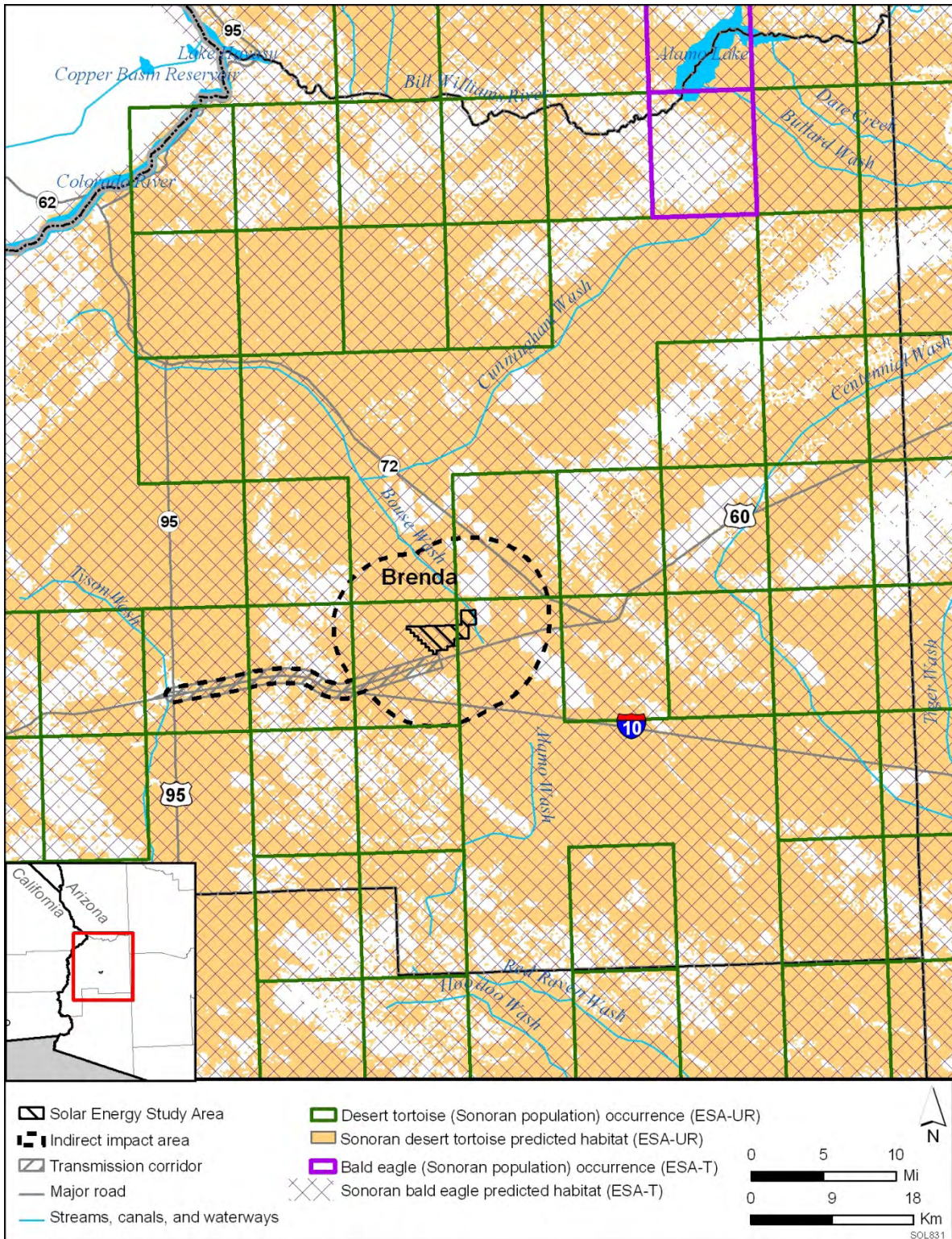
⁴ State listed species for the state of Arizona are those plants protected under the Arizona Native Plant Law or wildlife listed by the Arizona Game and Fish Department as Wildlife of Special Concern (WSC).

1 Brenda SEZ, the area of direct effect included the SEZ and the portion of the assumed
2 transmission corridor where ground-disturbing activities are assumed to occur. No new road
3 developments are expected to be needed to serve development on the SEZ because of the
4 proximity of existing infrastructure (refer to Section 8.1.1.2 for development assumptions). The
5 area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and the
6 portion of the assumed transmission corridor where ground-disturbing activities would not occur
7 but that could be indirectly affected by activities in the area of direct effect. Indirect effects
8 considered in the assessment included effects from surface runoff, dust, noise, lighting, and
9 accidental spills from the SEZ, but did not include ground-disturbing activities. The potential
10 magnitude of indirect effects would decrease with increasing distance away from the SEZ. This
11 area of indirect effect was identified on the basis of professional judgment and was considered
12 sufficiently large to bound the area that would potentially be subject to indirect effects. The
13 affected area includes both the direct and indirect effects areas.
14

15 The primary land cover habitat type within the affected area is Sonora-Mojave creosote
16 desert scrub (see Section 8.1.10). Potentially unique habitats in the affected area in which special
17 status species may reside include desert washes and associated riparian habitats. The only
18 potential aquatic habitat known to occur on the SEZ is Bouse Wash, an intermittent streambed
19 that exists along the easternmost boundary of the SEZ. The only other aquatic habitat within the
20 affected area is Tyson Wash, which occurs west of the SEZ in the transmission corridor
21 (Figure 8.1.12.1-1).
22

23 All special status species that are known to occur within the Brenda SEZ region
24 (i.e., within 50 mi [80 km] of the center of the SEZ) are listed, with their status, nearest recorded
25 occurrence, and habitats in Appendix J. Of these species, there are 20 that could be affected by
26 solar energy development on the SEZ, on the basis of recorded occurrences or the presence of
27 potentially suitable habitat in the area. These species, their status, and their habitats are presented
28 in Table 8.1.12.1-1. For many of the species listed in the table (especially plants), their predicted
29 potential occurrence in the affected area is based only on a general correspondence between
30 mapped SWReGAP land cover types and descriptions of species habitat preferences. This overall
31 approach to identifying species in the affected area probably overestimates the number of species
32 that actually occur in the affected area. For many of the species identified as having potentially
33 suitable habitat in the affected area, the nearest known occurrence is over 20 mi (32 m) away
34 from the SEZ.
35

36 Based on ANHP records, quad-level occurrences for two special status species intersect
37 the affected area of the Brenda SEZ: desert tortoise (Sonoran population) and California leaf-
38 nosed bat. The Sonoran population of the desert tortoise, occurring south and east of the
39 Colorado River, is currently under review for ESA listing as a threatened or endangered species.
40 This species is also a BLM-designated sensitive species and is listed by the state of Arizona
41 (Wildlife of Special Concern). The California leaf-nosed bat is a BLM-designated sensitive
42 species, listed by the state of Arizona (Wildlife of Special Concern); this species is also listed as
43 a species of concern by the USFWS. There are no groundwater-dependent species in the vicinity
44 of the SEZ based upon ANHP records, information provided by the USFWS (Stout 2009), and
45 the evaluation of groundwater resources in the Brenda SEZ region (Section 8.1.9).
46



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2

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4

5

FIGURE 8.1.12.1-1 Known or Potential Occurrences of Species Listed as Endangered or Threatened under the ESA, Candidate for Listing under the ESA, or Species under Review for ESA Listing in the Affected Area of the Proposed Brenda SEZ (Sources: Schwartz 2009; USFWS 2010b; USGS 2007)

TABLE 8.1.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Brenda SEZ

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Plants</i> Arid tansy-aster	<i>Machaeranthera arida</i>	AZ-S1	Low sand dunes, alkaline flats, riverbanks, and sandy roadsides. Nearest recorded quad-level occurrence is approximately 13 mi ⁱ north of the SEZ. About 154,000 acres ^j of potentially suitable habitat occurs within the SEZ region.	0 acres	50 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,438 acres of potentially suitable habitat (0.9% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of sand dunes, sand transport systems, and flats in the transmission corridor could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effect, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Plants (Cont.)</i>							
California fan palm	<i>Washingtonia filifera</i>	AZ-SR; AZ-S1	Desert riparian or oasis habitats in isolated areas of the Sonoran and Mojave deserts at elevations between 500 and 1,000 ft. ^k Nearest recorded quad-level occurrence is approximately 25 mi south of the SEZ. About 117,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	36 acres of potentially suitable riparian habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.
Mohave thistle	<i>Cirsium mohavense</i>	AZ-S1	Wetland habitats, perennial springs, moist canyons, streambanks, and poorly drained alkaline flats, seeps, and springs. Elevation ranges between 1,400 and 1,480 ft. Nearest recorded quad-level occurrence is from the Santa Maria River, approximately 45 mi northeast of the SEZ. About 138,500 acres of potentially suitable habitat occurs within the SEZ region.	0 acres.	0 acres	36 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.
Straw-top cholla	<i>Opuntia echinocarpa</i>	AZ-SR	Sandy or gravelly soil of benches, slopes, mesas, flats, and washes at elevations between 1,000 and 6,700 ft. Nearest recorded quad-level occurrence is approximately 15 mi northeast of the SEZ. About 123,500 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	36 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Utah swallowwort	<i>Cynanchum utahense</i>	AZ-S2	Mojave and Sonoran Desert scrub communities at elevations between 600 and 5,000 ft. Nearest recorded quad-level occurrence is approximately 13 mi west of the SEZ. About 4,458,000 acres of potentially suitable habitat occurs within the SEZ region.	3,100 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,350 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effect, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Note that these same potential mitigations apply to all special status plants.
Woolly heads	<i>Nemacaulis denudata</i>	AZ-S2	Desert dunes in Mojave and Sonoran Desert scrub communities at elevations below 1,600 ft. Nearest recorded quad-level occurrence is approximately 13 mi north of the SEZ. About 4,458,000 acres of potentially suitable habitat occurs within the SEZ region.	3,100 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,350 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. See Utah swallowwort for a list of potential mitigations applicable to all special status plant species.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Amphibians							
Lowland leopard frog	<i>Lithobates yavapaiensis</i>	BLM-S; AZ-WSC; FWS-SC	Aquatic systems in desert grasslands, pinyon-juniper woodlands, and agricultural areas including rivers, streams, beaver ponds, springs, earthen cattle tanks, livestock guzzlers, canals, and irrigation sloughs. Nearest recorded quad-level occurrence is approximately 22 mi east of the SEZ. About 189,500 acres of potentially suitable habitat occurs within the SEZ region.	128 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	30 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	5,325 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of agricultural and riparian habitats within the area of direct effects could reduce impacts on this species to negligible levels. In addition, pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effect, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Reptiles							
Desert rosy boa	<i>Charina trivirgata gracia</i>	BLM-S; FWS-SC	Scrublands, rocky deserts, and canyons with permanent or intermittent streams. Nearest recorded quad-level occurrence is approximately 7 mi east of the SEZ. About 3,583,000 acres of potentially suitable habitat occurs within the SEZ region.	1,392 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	531 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	53,800 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Desert tortoise (Sonoran population) ¹	<i>Gopherus agassizii</i>	ESA-UR; BLM-S; AZ-WSC	Desert creosotebush communities on firm soils for digging burrows; often along riverbanks, washes, canyon bottoms, creosote flats, and desert oases. Quad-level occurrences for this species intersect the SEZ. About 3,381,000 acres of potentially suitable habitat occurs within the SEZ region.	3,848 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	487 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	84,500 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effect, translocation of individuals from areas of direct effect, or compensatory mitigation of direct

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Desert tortoise (Sonoran population)¹ (Cont.)							effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in coordination with the USFWS and AZGFD.
Gila monster	<i>Heloderma suspectum</i>	FWS-SC	Rocky, deeply incised topography in desert scrub, desert riparian, oak woodland, and semi-desert grassland. Occurs in lower mountain slopes, rocky bajadas, canyon bottoms, and arroyos at elevations below 3,950 ft. Nearest recorded quad-level occurrence is approximately 7 mi east of the SEZ. About 3,611,000 acres of potentially suitable habitat occurs within the SEZ region.	3,834 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	530 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	90,000 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effect, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds							
American peregrine falcon	<i>Falco peregrinus anatum</i>	BLM-S; AZ-WSC; FWS-SC	Year-round resident in the SEZ region. Open habitats, including deserts, shrublands, and woodlands that are associated with high, near-vertical cliffs and bluffs above 200 ft. When not breeding, activity is concentrated in areas with ample prey, such as farmlands, marshes, lakes, rivers, and urban areas. Nearest recorded quad-level occurrence is from the vicinity of Alamo Lake, approximately 40 mi northeast of the SEZ. About 4,315,000 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	573 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	98,800 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	Small overall impact. No direct effect on nesting habitat. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Bald eagle (Sonoran population)	<i>Haliaeetus leucocephalus</i>	ESA-T; BLM-S; AZ-WSC; AZ-S2	Winter resident in the SEZ region, most commonly along large bodies of water where fish and waterfowl prey are available. May occasionally forage in arid shrubland habitats. Nearest recorded quad-level occurrence is from the vicinity of Alamo Lake, approximately 35 mi northeast of the SEZ. About 4,437,500 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	531 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	97,700 acres of potentially suitable foraging habitat (2.2% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Ferruginous hawk	<i>Buteo regalis</i>	BLM-S; AZ-WSC; FWS-SC; AZ-S2	Winter resident in the SEZ region. Grasslands, sagebrush, and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands throughout the project area. Populations are known to occur in La Paz County, Arizona. About 216,500 acres of potentially suitable foraging habitat occurs within the SEZ region.	0 acres	0 acres	7,000 acres of potentially suitable habitat (3.3% of available potentially suitable habitat)	Small overall impact on foraging habitat only; no direct effect. No species-specific mitigation is warranted.
Great egret	<i>Ardea alba</i>	BLM-S; AZ-WSC; AZ-S1	Year-round resident in the lower Colorado River Valley. Transient in the SEZ affected area. Primarily associated with open water areas such as marshes, estuaries, lagoons, lakes, ponds, rivers and flooded fields. Nearest recorded quad-level occurrence is from the Colorado River, approximately 35 mi west of the SEZ. About 27,700 acres of potentially suitable year-round foraging and nesting habitat occurs within the SEZ region.	0 acres	0 acres	170 acres of potentially suitable habitat (0.6% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.
Long-eared owl	<i>Asio otus</i>	FWS-SC; AZ-S2	Winter resident in the SEZ affected area. Deciduous and evergreen forests, orchards, wooded parks, farm woodlots, riparian areas, and desert oases. Nearest recorded quad-level occurrence is approximately 30 mi southeast of the SEZ. About 4,476,500 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	530 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	97,100 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Western burrowing owl	<i>Athene cunicularia hypugaea</i>	BLM-S; FWS-SC	Year-round resident in the SEZ region. Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dogs, badgers, etc.). Nearest recorded quad-level occurrence is approximately 50 mi southwest of the SEZ. About 4,124,000 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	531 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	97,700 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance occupied burrows in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mammals California leaf-nosed bat	<i>Macrotus californicus</i>	BLM-S; AZ-WSC; FWS-SC	Year-round resident in southern California and southwestern Arizona. May be locally common in some areas. Occurs in desert riparian, desert wash, desert scrub, and palm oasis habitats at elevations below 2,000 ft. Roosts in mines, caves, and buildings. Quad-level occurrences for this species intersect the SEZ. About 3,576,500 acres of potentially suitable habitat occurs within the SEZ region.	1,392 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	531 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	53,850 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect..

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Mammals (Cont.)							
Cave myotis	<i>Myotis velifer</i>	FWS-SC	Desert scrub, shrublands, washes, and riparian habitats. Roosts in colonies in caves. Nearest recorded quad-level occurrence is approximately 7 mi east of the SEZ. About 4,160,500 acres of potentially suitable habitat occurs within the SEZ region.	3,834 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	530 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	90,000 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	BLM-S; FWS-SC	Near forests and shrubland habitats below 9,000 ft elevation throughout the SEZ region. The species may use caves, mines, and buildings for day roosting and winter hibernation. May be a summer or year-round resident throughout the SEZ region. Nearest recorded quad-level occurrence is approximately 20 mi south of the SEZ. About 4,434,500 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	575 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	99,000 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Transmission Line (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Mammals (Cont.)							
Western yellow bat	<i>Lasiurus xanthinus</i>	BLM-S; AZ-WSC; AZ-S2	Year-round resident in desert riparian, desert wash, and palm oasis habitats at elevations below 2,000 ft. Roosts in trees. Nearest recorded quad-level occurrence is approximately 20 mi south of the SEZ. About 4,068,000 acres of potentially suitable habitat occurs within the SEZ region.	3,848 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	573 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,750 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance on all direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

^a AZ-S1 = ranked as S1 in the state of Arizona; AZ-S2 = ranked as S2 in the state of Arizona; AZ-SR = salvage restricted plant species under the Arizona Native Plant Law; AZ-WSC = listed as a wildlife species of concern in the state of Arizona; BLM-S = listed as a sensitive species by the BLM; ESA-T = listed as threatened under the ESA; ESA-UR = under review for listing under the ESA; FWS-SC = USFWS species of concern.

^b For plant species, potentially suitable habitat was determined by using SWReGAP land cover types. For terrestrial vertebrate species, potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

^c Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. No new access roads are assumed to be needed due to the proximity of existing roads to the SEZ.

^d Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

^e For transmission ROW development, direct effects were estimated within a 19-mi (30-km) long, 250-ft (76-m) wide ROW from the SEZ to the nearest existing transmission line. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide transmission corridor.

Footnotes continued on next page.

TABLE 8.1.12.1-1 (Cont.)

- ^f Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portion of the transmission corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. Indirect effects on groundwater-dependent species were considered outside these defined areas.
- ^g Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^h Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ⁱ To convert mi to km, multiply by 1.609.
- ^j To convert acres to km², multiply by 0.004047.
- ^k To convert ft to m, multiply by 0.3048.
- ^l Species in bold text have been recorded or have designated critical habitat within 5 mi (8 km) of the SEZ boundary.

1 **8.1.12.1.1 Species Listed under the Endangered Species Act That Could Occur in the**
2 **Affected Area**
3

4 In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS did not
5 express concern for impacts of project development within the SEZ on any species listed as
6 threatened or endangered under the ESA. However, according to SWReGAP information, the
7 Sonoran population of the bald eagle is currently listed under the ESA and has the potential to
8 occur within the affected area of the Brenda SEZ. This species is discussed below and
9 information on its habitat is presented in Table 8.1.12.1-1; additional basic information on life
10 history, habitat needs, and threats to populations of the desert tortoise is provided in Appendix J.
11

12 The Sonoran population of the bald eagle is currently listed as threatened under the
13 ESA, although recent findings by the USFWS have indicated that listing for this species is not
14 warranted (USFWS 2010b). According to ANHP records, the species is known to occur in the
15 vicinity of Alamo Lake, approximately 35 mi (56 km) northeast of the SEZ. This species is
16 primarily known to occur in riparian habitats associated with larger permanent water bodies such
17 as lakes, rivers, and reservoirs. However, it may occasionally forage in arid shrubland habitats.
18 According to the SWReGAP habitat suitability model, approximately 102,000 acres (413 km²)
19 of potentially suitable winter foraging habitat for the Sonoran population of the bald eagle may
20 occur in the affected area of the Brenda SEZ. Because there are no permanent surface water
21 features and little riparian habitat (36 acres [0.1 km²]) in the affected area, most of this
22 potentially suitable foraging habitat is represented by shrubland. Critical habitat has not been
23 designated for this species.
24
25

26 **8.1.12.1.2 Species That Are Candidates for Listing under the ESA**
27

28 In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS did not
29 express concern for impacts of project development within the SEZ on any species that are
30 candidates for listing under the ESA. There are no ANHP records or potentially suitable habitats
31 for any ESA candidate species within the affected area.
32
33

34 **8.1.12.1.3 Species That Are under Review for Listing under the ESA**
35

36 In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS identified
37 one species under ESA review that may be directly or indirectly affected by solar energy
38 development on the SEZ—the Sonoran population of the desert tortoise. This distinct
39 population segment of desert tortoise, which occurs south and east of the Colorado River, is
40 currently under review by the USFWS for listing under the ESA (Mojave populations north
41 and west of the Colorado River are currently listed as threatened under the ESA, but are outside
42 of the affected area of the Brenda SEZ). The Sonoran population of the desert tortoise was
43 petitioned for listing under the ESA on October 9, 2008 (WildEarth Guardians and Western
44 Watersheds Project 2008). Quad-level occurrences for this species intersect the Brenda SEZ and
45 other portions of the affected area (Figure 8.1.12.1-1). According to the SWReGAP land cover
46 model, approximately 3,848 acres (16 km²) of potentially suitable for this species occurs on the

1 SEZ; approximately 84,500 acres (342 km²) of potentially suitable habitat occurs in the area of
2 indirect effects (Table 8.1.12.1-1). Furthermore, the USGS desert tortoise model
3 (Nussear et al. 2009) identifies the SEZ affected area as potentially suitable habitat, where the
4 average modeled suitability value is greater than 0.6 (out of 1.0). There are no BLM-developed
5 suitable habitat categories for the desert tortoise within the proposed Brenda SEZ. However,
6 Category II desert tortoise habitat occurs in the transmission corridor; Category II and III suitable
7 habitats also occur in the area of indirect effects. These BLM habitat categories are used for
8 BLM planning and land management (as reviewed in WildEarth Guardians and Western
9 Watersheds Project 2008). Category I habitats are the most essential for the maintenance of
10 large, long-term populations; Category II habitats are intermediate in the maintenance of large,
11 long-term populations; Category III habitats are not essential to the maintenance of viable long-
12 term populations and are identified to limit further declines in the population size to the extent
13 practical. Additional basic information on life history, habitat needs, and threats to populations of
14 these species is provided in Appendix J.

15 16 17 **8.1.12.1.4 BLM-Designated Sensitive Species**

18
19 Twelve BLM-designated sensitive species may occur in the affected area of the Brenda
20 SEZ (Table 8.1.12.1-1). These BLM-designated sensitive species include the following
21 (1) amphibian: lowland leopard frog; (2) reptile: Sonoran desert tortoise and desert rosy boa;
22 (3) birds: American peregrine falcon, bald eagle, ferruginous hawk, great egret, long-eared owl,
23 and western burrowing owl; and (4) mammals: California leaf-nosed bat, Townsend's big-eared
24 bat, and western yellow bat. Of these BLM-designated sensitive species with potentially suitable
25 habitat in the affected area, only quad-level occurrences of the California leaf-nosed bat intersect
26 the affected area of the Brenda SEZ. Habitats in which BLM-designated sensitive species are
27 found, the amount of potentially suitable habitat in the affected area, and known locations of the
28 species relative to the SEZ are presented in Table 8.1.12.1-1. Two of these species—the desert
29 tortoise and bald eagle—have previously been discussed because of their current or pending
30 status under the ESA (Sections 8.1.12.1.1 and 8.1.12.1.3). All other BLM-designated sensitive
31 species as related to the SEZ are described in the remainder of this section. Additional life
32 history information for these species is provided in Appendix J.

33 34 35 **Lowland Leopard Frog**

36
37 The lowland leopard frog is primarily known from central and southern Arizona,
38 although the species is also known to occur in western New Mexico and northern Mexico.
39 It inhabits aquatic to mesic systems such as grasslands, pinyon-juniper forests, agricultural
40 areas, lakes, streams, and reservoirs. The nearest quad-level occurrences of this species are
41 approximately 22 mi (35 km) east of the SEZ. According to the SWReGAP habitat suitability
42 model, potentially suitable habitat for this species occurs in the SEZ and throughout portions of
43 the affected area (Table 8.1.12.1-1).

1 **Desert Rosy Boa**

2
3 The desert rosy boa is known from Arizona and southeastern California. This species
4 inhabits arid scrublands, rocky deserts, and canyons near washes or streams. The nearest quad-
5 level occurrences of this species are approximately 7 mi (11 km) east of the SEZ. According to
6 the SWReGAP habitat suitability model, potentially suitable habitat for this species occurs in
7 the SEZ and throughout portions of the affected area (Table 8.1.12.1-1).

8
9
10 **American Peregrine Falcon**

11
12 The American peregrine falcon is known throughout the western United States from areas
13 with high vertical cliffs and bluffs that overlook large open areas such as deserts, shrublands,
14 and woodlands. Nests are usually constructed on rock outcrops and cliff faces. Foraging habitat
15 varies from shrublands and wetlands to farmland and urban areas. The nearest recorded quad-
16 level occurrences of this species are from the vicinity of Alamo Lake, approximately 40 mi
17 (64 km) northeast of the SEZ (Table 8.1.12.1-1). According to the SWReGAP habitat suitability
18 model, potentially suitable year-round foraging and nesting habitat for the American peregrine
19 falcon may occur within the affected area of the Brenda SEZ. However, on the basis of an
20 evaluation of the SWReGAP land cover types, there is no suitable nesting habitat (cliffs or
21 outcrops) within the affected area.

22
23
24 **Ferruginous Hawk**

25
26 The ferruginous hawk is known to occur throughout the western United States.
27 According to the SWReGAP habitat suitability model, only potentially suitable winter foraging
28 habitat for this species may occur within the affected area of the Brenda SEZ. This species
29 inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper
30 woodlands. It is known to occur in La Paz County, Arizona. Suitable habitat for this species
31 does not occur on the Brenda SEZ or within the transmission corridor; however, potentially
32 suitable foraging habitat occurs in portions of the area of indirect effects outside of the SEZ
33 (Table 8.1.12.1-1).

34
35
36 **Great Egret**

37
38 The great egret is considered to be a year-round resident in the lower Colorado River
39 Valley in southwestern Arizona and southeastern California. This species is primarily associated
40 with open water areas such as marshes, lakes, ponds, and reservoirs. The nearest recorded quad-
41 level occurrences of this species are from the Colorado River, approximately 35 mi (56 km) west
42 of the SEZ (Table 8.1.12.1-1). According to the SWReGAP habitat suitability model, potentially
43 suitable year-round habitat may occur outside of the SEZ within the area of indirect effects east
44 of Bouse Wash. There are no permanent surface water features in the affected area that may
45 provide suitable habitat; therefore, this species may only occur in the affected area as a transient.

1 **Western Burrowing Owl**

2
3 According to the SWReGAP habitat suitability model for the western burrowing owl,
4 potentially suitable year-round foraging and nesting habitat may occur in the affected area of the
5 Brenda SEZ. The species forages in grasslands, shrublands, and open disturbed areas, and nests
6 in burrows usually constructed by mammals. The species is known to occur in La Paz County,
7 Arizona; the nearest quad-level occurrences are approximately 50 mi (80 km) southwest of the
8 SEZ. Potentially suitable foraging and breeding habitat is expected to occur in the SEZ and in
9 other portions of the affected area (Table 8.1.12.1-1). The availability of nest sites (burrows)
10 within the affected area has not been determined, but shrubland habitat that may be suitable for
11 either foraging or nesting occurs throughout the affected area.
12

13
14 **California Leaf-Nosed Bat**

15
16 The California leaf-nosed bat is a large-eared bat with a leaf-like flap of protective skin
17 on the tip of its nose. It primarily occurs along the Colorado River, from southern Nevada
18 through Arizona and California to Baja, California, and Sinaloa, Mexico. The species forages in
19 a variety of desert habitats including desert riparian, desert wash, desert scrub, and palm oasis. It
20 roosts in caves, crevices, and mines. Quad-level occurrences of this species intersect the Brenda
21 SEZ and other portions of the affected area. According to the SWReGAP habitat suitability
22 model, potentially suitable year-round foraging habitat for this species may occur on the SEZ
23 and throughout the affected area (Table 8.1.12.1-1). On the basis of an evaluation of SWReGAP
24 land cover types, however, there is no suitable roosting habitat (rocky cliffs and outcrops) within
25 the affected area.
26

27
28 **Townsend’s Big-Eared Bat**

29
30 The Townsend’s big-eared bat is a year-round resident in the Brenda SEZ region, where
31 it forages in a wide variety of desert and non-desert habitats. The species roosts in caves, mines,
32 tunnels, buildings, and other man-made structures. The nearest recorded occurrences of this
33 species are approximately 20 mi (32 km) south of the SEZ. According to the SWReGAP habitat
34 suitability model, potentially suitable year-round foraging habitat for this species may occur on
35 the SEZ and throughout the affected area (Table 8.1.12.1-1). On the basis of an evaluation of
36 SWReGAP land cover types, however, there is no suitable roosting habitat (rocky cliffs and
37 outcrops) within the affected area.
38

39
40 **Western Yellow Bat**

41
42 The western yellow bat is an uncommon year-round resident in the Brenda SEZ region,
43 where it forages in desert riparian and desert oasis habitats and roosts in trees. The nearest
44 recorded occurrences of this species are approximately 20 mi (32 km) south of the SEZ.
45 According to the SWReGAP habitat suitability model, potentially suitable year-round
46 foraging habitat for this species may occur on the SEZ and throughout the affected area

1 (Table 8.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, however,
2 there is no suitable roosting habitat (woodlands) within the affected area.
3
4

5 **8.1.12.1.5 State-Listed Species**

6

7 There are 10 species listed by the state of Arizona that may occur in the Brenda SEZ
8 affected area (Table 8.1.12.1-1). These state-listed species include the following (1) plants:
9 California fan palm and straw-top cholla; (2) amphibian: lowland leopard frog; (3) reptile:
10 desert tortoise; (4) birds: American peregrine falcon, bald eagle, ferruginous hawk, and great
11 egret; and (5) mammals: California leaf-nosed bat and western yellow bat. All of these species
12 are protected in the state of Arizona under the Arizona Native Plant Law or by the Arizona Game
13 and Fish Department (AZGFD) as Wildlife of Special Concern (WSC). Of these species, the
14 California fan palm and straw-top cholla have not been previously described as ESA-listed
15 (Section 8.1.12.1.1), under review for ESA listing (Section 8.1.12.1.3), or BLM-designated
16 sensitive (Section 8.1.12.1.4). These species as related to the SEZ are described in this section
17 and Table 8.1.12.1-1. Additional life history information for these species is provided in
18 Appendix J.
19
20

21 **California Fan Palm**

22

23 The California fan palm is a perennial tree known from California and western Arizona.
24 This species inhabits desert riparian and oasis areas in the Mojave and Sonoran Deserts. The
25 nearest quad-level occurrences are approximately 25 mi (40 km) south of the Brenda SEZ (Table
26 8.1.12.1-1). According to the SWReGAP land cover model, potentially suitable habitat does not
27 occur on the SEZ or within the transmission corridor; however, approximately 36 acres (0.1
28 km²) of potentially suitable desert riparian habitat exists in the area of indirect effects outside of
29 the SEZ.
30
31

32 **Straw-Top Cholla**

33

34 The straw-top cholla is a perennial shrub-like cactus that is known from the southwestern
35 United States. This species inhabits sandy or gravelly soils on desert flats, mesas, and washes.
36 The nearest quad-level occurrences are approximately 15 mi (24 km) northeast of the Brenda
37 SEZ (Table 8.1.12.1-1). According to the SWReGAP land cover model, potentially suitable
38 habitat does not occur on the SEZ or within the transmission corridor; however, approximately
39 36 acres (0.1 km²) of potentially suitable desert riparian habitat exists in the area of indirect
40 effects outside of the SEZ.
41
42
43

1 **8.1.12.1.6 Rare Species**
2

3 There are 18 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern
4 by the USFWS) that may be affected by solar energy development on the Brenda SEZ
5 (Table 8.1.12.1-1). Of these species, there are eight rare species that have not been discussed
6 previously. These include the following (1) plants: arid tansy-aster, Mohave thistle, Utah
7 swallowwort, woolly heads; (2) reptile: Gila monster; (3) bird: long-eared owl; and (4) mammal:
8 cave myotis. These species as related to the SEZ are described in Table 8.1.12.1-1.
9

10 **8.1.12.2 Impacts**
11

12 The potential for impacts on special status species from utility-scale solar energy
13 development within the proposed Brenda SEZ is presented in this section. The types of impacts
14 that special status species could incur from construction and operation of utility-scale solar
15 energy facilities are discussed in Section 5.10.4.
16

17 The assessment of impacts on special status species is based on available information
18 on the presence of species in the affected area as presented in Section 8.1.12.1 following the
19 analysis approach described in Appendix M. It is assumed that, prior to development, surveys
20 would be conducted to determine the presence of special status species and their habitats in and
21 near areas where ground-disturbing activities would occur. Additional NEPA assessments, ESA
22 consultations, and coordination with state natural resource agencies may be needed to address
23 project-specific impacts more thoroughly. These assessments and consultations could result in
24 additional required actions to avoid, minimize, or mitigate impacts on special status species
25 (see Section 8.1.12.3).
26

27 Solar energy development within the Brenda SEZ could affect a variety of habitats
28 (see Sections 8.1.9 and 8.1.10). These impacts on habitats could in turn affect special status
29 species that are dependent on those habitats. Based on ANHP records, quad-level occurrences of
30 the following two special status species intersect the Brenda SEZ: desert tortoise and California
31 leaf-nosed bat. These species are listed in bold in Table 8.1.12.1-1. Other special status species
32 may occur on the SEZ or within the affected area on the basis of the presence of potentially
33 suitable habitat. As discussed in Section 8.1.12.1, this approach to identifying the species that
34 could occur in the affected area probably overestimates the number of species that actually occur
35 in the affected area, and may therefore overestimate impacts on some special status species.
36

37 Potential direct and indirect impacts on special status species within the SEZ and in the
38 area of indirect effect outside the SEZ are presented in Table 8.1.12.1-1. In addition, the overall
39 potential magnitude of impacts on each species (assuming programmatic design features are in
40 place) is presented along with any potential species-specific mitigation measures that could
41 further reduce impacts.
42

43 Impacts on special status species could occur during all phases of development
44 (construction, operation, and decommissioning and reclamation) of a utility-scale solar energy
45 project within the SEZ. Construction and operation activities could result in short- or long-term
46

1 impacts on individuals and their habitats, especially if these activities are sited in areas where
2 special status species are known to occur or could occur. As presented in Section 8.1.1.2, it is
3 assumed that a new 19-mi (30-km) long transmission ROW would be created within a locally
4 designated corridor from the western boundary of the SEZ to the nearest existing transmission
5 line. No new access roads would be needed to serve solar energy developments within this SEZ
6 due to the proximity of an existing U.S. highway (U.S. 60).
7

8 Direct impacts would result from habitat destruction or modification. It is assumed that
9 direct impacts would occur only within the SEZ and transmission corridor where ground-
10 disturbing activities are expected to occur. Indirect impacts could result from depletions of
11 groundwater resources, surface water and sediment runoff from disturbed areas, fugitive dust
12 generated by project activities, accidental spills, harassment, and lighting. No ground-disturbing
13 activities associated with project developments are anticipated to occur within the area of
14 indirect effects. Decommissioning of facilities and reclamation of disturbed areas after
15 operations cease could result in short-term negative impacts on individuals and habitats adjacent
16 to project areas, but long-term benefits would accrue if original land contours and native plant
17 communities were restored in previously disturbed areas.
18

19 The successful implementation of programmatic design features (discussed in
20 Appendix A, Section A.2.2) would reduce direct impacts on some special status species,
21 especially those that depend on habitat types that can be easily avoided (e.g., rock outcrops and
22 playa habitats). Indirect impacts on special status species could be reduced to negligible levels by
23 implementing programmatic design features, especially those engineering controls that would
24 reduce groundwater consumption, runoff, sedimentation, spills, and fugitive dust.
25
26

27 ***8.1.12.2.1 Impacts on Species Listed under the ESA***

28
29
30 In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS did not
31 express concern for impacts of project development within the SEZ on any species listed as
32 threatened or endangered under the ESA. However, the Sonoran population of the bald eagle is
33 currently listed under the ESA and has the potential to occur within the affected area of the
34 Brenda SEZ on the basis of SWReGAP information.
35

36 The Sonoran population of the bald eagle is currently listed as threatened under the ESA⁵
37 and is known to occur in the vicinity of Alamo Lake, approximately 35 mi (56 km) northeast of
38 the SEZ (Figure 8.1.12.1-1). According to the SWReGAP habitat suitability model, only winter
39 foraging habitat is expected to occur in the affected area of the Brenda SEZ. Approximately
40 3,878 acres (16 km²) of potentially suitable foraging habitat within the SEZ and 531 acres (2
41 km²) of potentially suitable foraging habitat within the transmission corridor could be directly
42 affected by construction and operations of solar energy development on the SEZ. This direct
43 effects area represents about 0.1% of available suitable habitat in the region. About 97,700 acres

⁵ A recent finding by the USFWS has indicated that listing of this species under the ESA is no longer warranted (USFWS 2010b).

1 (395 km²) of suitable foraging habitat occurs in the area of potential indirect effects; this area
2 represents about 2.2% of the available suitable habitat in the region (Table 8.1.12.1-1). On the
3 basis of SWReGAP land cover data, there are no permanent surface water features and little
4 riparian habitat (36 acres [0.1 km²]) in the affected area. Therefore, most of this potentially
5 suitable foraging habitat is desert shrubland.
6

7 The overall impact on the bald eagle from construction, operation, and decommissioning
8 of utility-scale solar energy facilities within the Brenda SEZ is considered small because the
9 amount of potentially suitable foraging habitat for this species in the area of direct effects
10 represents less than 1% of potentially suitable foraging habitat in the SEZ region. The
11 implementation of programmatic design features is expected to be sufficient to reduce indirect
12 impacts on this species to negligible levels; however, avoidance of all potentially suitable
13 foraging habitat is not a feasible way to mitigate impacts to this species because potentially
14 suitable foraging habitat (shrubland) is widespread in the area of direct effect and readily
15 available in other portions of the affected area.
16

17 Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
18 reasonable and prudent measures, and terms and conditions) on the Sonoran population of the
19 bald eagle, including development of a survey protocol, avoidance measures, minimization
20 measures, and, potentially, compensatory mitigation, would require consultation with the
21 USFWS per Section 7 of the ESA. These consultations may also be used to develop incidental
22 take statements in accordance with Section 10 of the ESA (if necessary). Consultation with
23 AZGFD should also occur to determine any state mitigation requirements.
24
25

26 ***8.1.12.2.2 Impacts on Species That Are Candidates for Listing under the ESA*** 27

28 In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS did not
29 express concern for impacts of project development within the SEZ on any species that are
30 candidates for listing under the ESA. There are no ANHP records or potentially suitable habitats
31 for any ESA candidate species within the affected area.
32
33

34 ***8.1.12.2.3 Impacts on Species That Are under Review for Listing under the ESA*** 35

36 In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS identified
37 one species under ESA review that may be directly or indirectly affected by solar energy
38 development on the SEZ—the Sonoran population of the desert tortoise. This distinct population
39 segment of desert tortoise, which occurs south and east of the Colorado River, is currently under
40 review by the USFWS for listing under the ESA (Mojave populations north and west of the
41 Colorado River are currently listed as threatened under the ESA, but are outside of the affected
42 area of the Brenda SEZ). Quad-level occurrences for this species intersect the Brenda SEZ and
43 other portions of the affected area (Figure 8.1.12.1-1). There are no BLM-developed suitable
44 habitat categories for the desert tortoise within the Brenda SEZ. However, Category II habitat
45 occurs in the transmission corridor; Category II and III suitable habitats also occur in the area of
46 indirect effects. These BLM habitat categories are used for BLM planning and land management

1 (as reviewed in WildEarth Guardians and Western Watersheds Project 2008). According to the
2 SWReGAP habitat suitability model, approximately 3,848 acres (16 km²) of potentially suitable
3 habitat on the SEZ and 487 acres (2 km²) of potentially suitable habitat within the transmission
4 corridor could be directly affected by construction and operations of solar energy development
5 on the SEZ (Table 8.1.12.1-1). This direct effects area represents about 0.1% of available
6 suitable habitat of the desert tortoise in the region. About 84,500 acres (342 km²) of suitable
7 habitat occurs in the area of potential indirect effects; this area represents about 2.5% of the
8 available suitable habitat in the region (Table 8.1.12.1-1).

9
10 The overall impact on the Sonoran population of the desert tortoise from construction,
11 operation, and decommissioning of utility-scale solar energy facilities within the Brenda SEZ
12 is considered small because the amount of potentially suitable habitat for this species in the
13 area of direct effects represents less than 1% of potentially suitable habitat in the region. The
14 implementation of programmatic design features alone is unlikely to reduce these impacts to
15 negligible levels. Avoidance of potentially suitable habitats for this species is not a feasible
16 means of mitigating impacts because these habitats (desert scrub) are widespread throughout the
17 area of direct effect. Pre-construction surveys to determine the abundance of desert tortoises on
18 the SEZ, avoiding or minimizing disturbance to occupied habitats, and the implementation of a
19 desert tortoise translocation plan and compensation plan could further reduce direct impacts.

20
21 Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
22 reasonable and prudent measures, and terms and conditions) for the desert tortoise, including a
23 survey protocol, avoidance measures, minimization measures, and, potentially, translocation
24 actions, and compensatory mitigation, should be conducted in coordination with the USFWS and
25 AZDFG. There are inherent dangers to tortoises associated with their capture, handling, and
26 translocation from the SEZ. These actions, if done improperly, can result in injury or death. To
27 minimize these risks, the desert tortoise translocation plan should be developed in consultation
28 with the USFWS, and follow the *Guidelines for Handling Desert Tortoises During Construction*
29 *Projects* (Desert Tortoise Council 1994) and other current translocation guidance provided by the
30 USFWS or other state agencies. Consultation will identify potentially suitable recipient
31 locations, density thresholds for tortoise populations in recipient locations, procedures for
32 pre-disturbance clearance surveys and tortoise handling, as well as disease testing and post-
33 translocation monitoring and reporting requirements. Despite some risk of mortality or decreased
34 fitness, translocation is widely accepted as a useful strategy for the conservation of the desert
35 tortoise (Field et al. 2007).

36
37 To offset impacts of solar development on the SEZ, compensatory mitigation may be
38 needed to balance the acreage of habitat lost with acquisition of lands that would be improved
39 and protected for desert tortoise populations (USFWS 1994). Compensation can be accomplished
40 by improving the carrying capacity for the desert tortoise on the acquired lands. Other mitigation
41 actions may include funding for the enhancement of desert tortoise habitat on existing federal
42 lands. Coordination with the USFWS and AZGFD would be necessary to determine the
43 appropriate mitigation ratio to acquire, enhance, and preserve desert tortoise compensation lands.

1 **8.1.12.2.4 Impacts on BLM-Designated Sensitive Species**
2

3 BLM-designated sensitive species that may be affected by solar energy development on
4 the Brenda SEZ and that are not previously discussed are discussed below.
5

6
7 **Lowland Leopard Frog**
8

9 The lowland leopard frog is not known to occur in the affected area of the Brenda SEZ;
10 however, approximately 128 acres (0.5 km²) of potentially suitable habitat on the SEZ and
11 30 acres (0.1 km²) of potentially suitable habitat in the transmission corridor could be directly
12 affected by construction and operations (Table 8.1.12.1-1). Some of this potentially suitable
13 habitat occurs along Bouse Wash in the eastern portion of the SEZ and along Tyson Wash
14 outside of the SEZ in the transmission corridor. This direct impact area represents about 0.1% of
15 potentially suitable habitat in the SEZ region. About 5,323 acres (22 km²) of potentially suitable
16 habitat occurs in the area of indirect effects; this area represents about 2.8% of the potentially
17 suitable habitat in the SEZ region (Table 8.1.12.1-1).
18

19 The overall impact on the lowland leopard frog from construction, operation, and
20 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
21 small because the amount of potentially suitable habitat for this species in the area of direct
22 effects represents less than 1% of potentially suitable habitat in the SEZ region. The
23 implementation of programmatic design features is expected to be sufficient to reduce indirect
24 impacts to negligible levels.
25

26 Avoiding or minimizing disturbance to agricultural, aquatic, and riparian (e.g. desert
27 wash) habitats within the area of direct effects could reduce impacts on this species to negligible
28 levels. In addition, impacts could be reduced by conducting pre-disturbance surveys and
29 avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance
30 or minimization is not a feasible option, individuals could be translocated from the area of direct
31 effects to protected areas that would not be affected directly or indirectly by future development.
32 Alternatively, or in combination with translocation, a compensatory mitigation plan could be
33 developed and implemented to mitigate direct effects on occupied habitats. Compensation could
34 involve the protection and enhancement of existing occupied or suitable habitats to compensate
35 for habitats lost to development. A comprehensive mitigation strategy that used one or more of
36 these options could be designed to completely offset the impacts of development.
37
38

39 **Desert Rosy Boa**
40

41 The desert rosy boa is known to occur within the SEZ region and potentially suitable
42 habitat is expected to occur in the affected area. Approximately 1,392 acres (6 km²) of
43 potentially suitable habitat on the SEZ and 531 acres (2 km²) of potentially suitable habitat
44 in the transmission corridor could be directly affected by construction and operations
45 (Table 8.1.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the
46 SEZ region. About 53,800 acres (218 km²) of potentially suitable habitat occurs in the area of

1 indirect effects; this area represents about 1.5% of the potentially suitable habitat in the SEZ
2 region (Table 8.1.12.1-1).

3
4 The overall impact on the desert rosy boa from construction, operation, and
5 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
6 small because the amount of potentially suitable foraging habitat for this species in the area of
7 direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The
8 implementation of programmatic design features is expected to be sufficient to reduce indirect
9 impacts on this species to negligible levels.

10
11 Avoidance of all potentially suitable habitats to mitigate impacts on the desert rosy boa is
12 not feasible because potentially suitable desert scrub and wash habitats are widespread
13 throughout the area of direct effect. However, direct impacts could be reduced by conducting
14 pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area
15 of direct effects. If avoidance or minimization is not a feasible option, individuals could be
16 translocated from the area of direct effects to protected areas that would not be affected directly
17 or indirectly by future development. Alternatively, or in combination with translocation, a
18 compensatory mitigation plan could be developed and implemented to mitigate direct effects on
19 occupied habitats. Compensation could involve the protection and enhancement of existing
20 occupied or suitable habitats to compensate for habitats lost to development. A comprehensive
21 mitigation strategy that used one or more of these options could be designed to completely offset
22 the impacts of development.

23 24 25 **American Peregrine Falcon**

26
27 The American peregrine falcon is a year-round resident in the Brenda SEZ region and
28 potentially suitable foraging habitat is expected to occur in the affected area. Approximately
29 3,878 acres (16 km²) of potentially suitable habitat on the SEZ and 573 acres (2 km²) of
30 potentially suitable habitat in the transmission corridor could be directly affected by construction
31 and operations (Table 8.1.12.1-1). This direct impact area represents 0.1% of potentially suitable
32 habitat in the SEZ region. About 98,800 acres (400 km²) of potentially suitable habitat occurs in
33 the area of indirect effects; this area represents about 2.3% of the potentially suitable habitat in
34 the SEZ region (Table 8.1.12.1-1). Most of this area could serve as foraging habitat (open
35 shrublands). On the basis of SWReGAP land cover data, there is no suitable nesting habitat
36 (cliffs or outcrops) within the affected area.

37
38 The overall impact on the American peregrine falcon from construction, operation, and
39 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
40 small because the amount of potentially suitable foraging habitat for this species in the area of
41 direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region.
42 The implementation of programmatic design features is expected to be sufficient to reduce
43 indirect impacts on this species to negligible levels. Avoidance of all potentially suitable
44 foraging habitats to mitigate impacts on the American peregrine falcon is not feasible because
45 potentially suitable foraging habitats are widespread throughout the area of direct effect and
46 readily available in other portions of the affected area.

1 **Ferruginous Hawk**

2
3 The ferruginous hawk is a winter resident in the Brenda SEZ region and potentially
4 suitable foraging habitat is expected to occur in the affected area. According to the SWReGAP
5 habitat suitability model, suitable habitat for this species does not occur on the SEZ or within the
6 transmission corridor. However, about 7,000 acres (28 km²) of potentially suitable foraging
7 habitat occurs in the area of indirect effects; this area represents about 3.3% of the potentially
8 suitable habitat in the SEZ region (Table 8.1.12.1-1).

9
10 The overall impact on the ferruginous hawk from construction, operation, and
11 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
12 small because no potentially suitable habitat for this species occurs in the area of direct effects,
13 and only indirect effects are possible. The implementation of programmatic design features is
14 expected to be sufficient to reduce indirect impacts to negligible levels.

15
16
17 **Great Egret**

18
19 The great egret is a year-round resident in the Brenda SEZ region and potentially suitable
20 habitat is expected to occur in the affected area. According to the SWReGAP habitat suitability
21 model, suitable habitat does not occur on the SEZ or within the transmission corridor. However,
22 approximately 170 acres (0.7 km²) of potentially suitable habitat occurs in the area of
23 indirect effects; this area represents about 0.6% of the potentially suitable habitat in the SEZ
24 region (Table 8.1.12.1-1). Because there are no permanent surface water features in the affected
25 area that may provide suitable foraging or nesting habitat, this species may occur in the affected
26 area only as a transient.

27
28 The overall impact on the great egret from construction, operation, and decommissioning
29 of utility-scale solar energy facilities within the Brenda SEZ is considered small because no
30 potentially suitable habitat for this species occurs in the area of direct effects, and only indirect
31 effects are possible. The implementation of programmatic design features is expected to be
32 sufficient to reduce indirect impacts to negligible levels.

33
34
35 **Western Burrowing Owl**

36
37 The western burrowing owl is a year-round resident in the Brenda SEZ region and
38 potentially suitable foraging and nesting habitat is expected to occur in the affected area.
39 Approximately 3,878 acres (16 km²) of potentially suitable habitat on the SEZ and 531 acres
40 (2 km²) of potentially suitable habitat in the transmission corridor could be directly affected
41 by construction and operations (Table 8.1.12.1-1). This direct impact area represents 0.1% of
42 potentially suitable habitat in the SEZ region. About 97,700 acres (395 km²) of potentially
43 suitable habitat occurs in the area of indirect effects; this area represents about 2.4% of the
44 potentially suitable habitat in the SEZ region (Table 8.1.12.1-1). Most of this area could serve as
45 foraging and nesting habitat (shrublands). The abundance of burrows suitable for nesting on the
46 SEZ and in the area of indirect effects has not been determined.

1 The overall impact on the western burrowing owl from construction, operation, and
2 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
3 small because the amount of potentially suitable habitat for this species in the area of direct
4 effects represents less than 1% of potentially suitable habitat in the SEZ region. The
5 implementation of programmatic design features is expected to be sufficient to reduce indirect
6 impacts to negligible levels.

7
8 Avoidance of all potentially suitable habitats is not a feasible way to mitigate impacts on
9 the western burrowing owl because potentially suitable desert scrub habitats are widespread
10 throughout the area of direct effect and readily available in other portions of the SEZ region.
11 Impacts on the western burrowing owl could be reduced to negligible levels through the
12 implementation of programmatic design features and by conducting pre-disturbance surveys and
13 avoiding or minimizing disturbance to occupied burrows in the area of direct effects. If
14 avoidance or minimization is not a feasible option, a compensatory mitigation plan could be
15 developed and implemented to mitigate direct effects on occupied habitats. Compensation could
16 involve the protection and enhancement of existing occupied or suitable habitats to compensate
17 for habitats lost to development. A comprehensive mitigation strategy that used one or both of
18 these options could be designed to completely offset the impacts of development. The need for
19 mitigation, other than programmatic design features, should be determined by conducting pre-
20 construction surveys for the species and its habitat in the area of direct effects.

21 22 23 **California Leaf-Nosed Bat**

24
25 The California leaf-nosed bat is a year-round resident within the Brenda SEZ region.
26 On the basis of SWReGAP land cover data, suitable roosting habitats (caves and mines) do
27 not occur in the affected area. However, approximately 1,392 acres (6 km²) of potentially
28 suitable foraging habitat on the SEZ and 531 acres (2 km²) of potentially suitable foraging
29 habitat in the transmission corridor could be directly affected by construction and operations
30 (Table 8.1.12.1-1). This direct impact area represents about 0.1% of potentially suitable foraging
31 habitat in the region. About 53,850 acres (218 km²) of potentially suitable foraging habitat
32 occurs in the area of indirect effect; this area represents about 1.5% of the available suitable
33 foraging habitat in the region (Table 8.1.12.1-1). The potentially suitable habitat in the affected
34 area is primarily foraging habitat represented by desert shrubland. On the basis of an evaluation
35 of SWReGAP landcover types, there are no potentially suitable roosting habitats (rocky cliffs
36 and outcrops) in the affected area.

37
38 The overall impact on the California leaf-nosed bat from construction, operation, and
39 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
40 small because the amount of potentially suitable habitat for this species in the area of direct
41 effects represents less than 1% of potentially suitable habitat in the region. The implementation
42 of programmatic design features may be sufficient to reduce indirect impacts on this species to
43 negligible levels. Avoidance of all potentially suitable foraging habitats is not a feasible way to
44 mitigate impacts because potentially suitable habitat is widespread throughout the area of direct
45 effect and readily available in other portions of the SEZ region.

1 **Townsend’s Big-Eared Bat**

2
3 The Townsend’s big-eared bat is a year-round resident within the Brenda SEZ region.
4 On the basis of SWReGAP land cover data, suitable roosting habitats (caves and mines) do
5 not occur in the affected area. However, approximately 3,878 acres (16 km²) of potentially
6 suitable foraging habitat on the SEZ and 575 acres (2 km²) of potentially suitable foraging
7 habitat in the transmission corridor could be directly affected by construction and operations
8 (Table 8.1.12.1-1). This direct impact area represents about 0.1% of potentially suitable foraging
9 habitat in the region. About 99,000 acres (401 km²) of potentially suitable foraging habitat
10 occurs in the area of indirect effect; this area represents about 2.2% of the available suitable
11 foraging habitat in the region (Table 8.1.12.1-1). The potentially suitable habitat in the affected
12 area is primarily foraging habitat represented by desert shrubland. On the basis of an evaluation
13 of SWReGAP landcover types, there are no potentially suitable roosting habitats (rocky cliffs
14 and outcrops) in the affected area.
15

16 The overall impact on the California leaf-nosed bat from construction, operation, and
17 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
18 small because the amount of potentially suitable habitat for this species in the area of direct
19 effects represents less than 1% of potentially suitable habitat in the region. The implementation
20 of programmatic design features may be sufficient to reduce indirect impacts on this species to
21 negligible levels. Avoidance of all potentially suitable foraging habitats is not a feasible way of
22 mitigating impacts because potentially suitable habitat is widespread throughout the area of
23 direct effect and readily available in other portions of the SEZ region.
24
25

26 **Western Yellow Bat**

27
28 The western yellow bat is an uncommon year-round resident within the Brenda SEZ
29 region. On the basis of SWReGAP land cover data, suitable roosting habitats (trees) do not
30 occur in the affected area. However, approximately 3,848 acres (16 km²) of potentially
31 suitable foraging habitat on the SEZ and 573 acres (2 km²) of potentially suitable foraging
32 habitat in the transmission corridor could be directly affected by construction and operations
33 (Table 8.1.12.1-1). This direct impact area represents about 0.1% of potentially suitable foraging
34 habitat in the region. About 91,750 acres (371 km²) of potentially suitable foraging habitat
35 occurs in the area of indirect effect; this area represents about 2.2% of the available suitable
36 foraging habitat in the region (Table 8.1.12.1-1). The potentially suitable habitat in the affected
37 area is primarily foraging habitat represented by desert shrubland. On the basis of an evaluation
38 of SWReGAP landcover types, there are no potentially suitable roosting habitats (woodlands) in
39 the affected area.
40

41 The overall impact on the western yellow bat from construction, operation, and
42 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
43 small because the amount of potentially suitable habitat for this species in the area of direct
44 effects represents less than 1% of potentially suitable foraging habitat in the region. The
45 implementation of programmatic design features may be sufficient to reduce indirect impacts on
46 this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a

1 feasible way to mitigate impacts because potentially suitable habitat is widespread throughout
2 the area of direct effect and is readily available in other portions of the SEZ region.

3
4
5 **8.1.12.2.5 Impacts on State-Listed Species**
6

7 There are 10 species listed by the state of Arizona that may occur in the Brenda SEZ
8 affected area (Table 8.1.12.1-1). Of these species, only the California fan palm and straw-top
9 cholla have not been previously discussed as listed under the ESA, under review for ESA listing,
10 or BLM-designated sensitive. Impacts on each of these species are discussed below.
11

12
13 **California Fan Palm**
14

15 The California fan palm is not known to occur in the affected area of the Brenda SEZ
16 and, according to the SWReGAP land cover model, suitable desert riparian or oasis habitat does
17 not occur on the site or within the transmission corridor. However, approximately 36 acres
18 (0.1 km²) of potentially suitable desert riparian habitat occurs in the area of indirect effects;
19 this area represents less than 0.1% of the potentially suitable habitat in the SEZ region
20 (Table 8.1.12.1-1).
21

22 The overall impact on the California fan palm from construction, operation, and
23 decommissioning of utility-scale solar energy facilities within the proposed Brenda SEZ is
24 considered small because no potentially suitable habitat for this species occurs in the area of
25 direct effects and only indirect effects are possible. The implementation of programmatic design
26 features is expected to be sufficient to reduce indirect impacts to negligible levels.
27

28
29 **Straw-Top Cholla**
30

31 The straw-top cholla is not known to occur in the affected area of the Brenda SEZ and,
32 according to the SWReGAP land cover model, suitable desert riparian, wash, or mesa habitat
33 does not occur on the site or within the transmission corridor. However, approximately 36 acres
34 (0.1 km²) of potentially suitable desert riparian habitat occurs in the area of indirect effects; this
35 area represents less than 0.1% of the potentially suitable habitat in the SEZ region
36 (Table 8.1.12.1-1).
37

38 The overall impact on the straw-top cholla from construction, operation, and
39 decommissioning of utility-scale solar energy facilities within the Brenda SEZ is considered
40 small because no potentially suitable habitat for this species occurs in the area of direct effects
41 and only indirect effects are possible. The implementation of programmatic design features is
42 expected to be sufficient to reduce indirect impacts to negligible levels.
43
44
45

1 **8.1.12.2.6 Impacts on Rare Species**
2

3 There are 18 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern
4 by the USFWS) that may be affected by solar energy development on the Brenda SEZ
5 (Table 8.1.12.1-1). Impacts on eight rare species have not been discussed previously. These
6 include the following (1) plants: arid tansy-aster, Mohave thistle, Utah swallowwort, and woolly
7 heads; (2) reptile: Gila monster; (3) bird: long-eared owl; and (4) mammal: cave myotis. Impacts
8 on these species are described in Table 8.1.12.1-1.
9

10 **8.1.12.3 SEZ-Specific Design Features and Design Feature Effectiveness**
11

12 The implementation of programmatic design features described in Appendix A,
13 Section A.2.2, would greatly reduce or eliminate the potential for effects of utility-scale solar
14 energy development on special status species. While some SEZ-specific mitigation measures are
15 best established when specific project details are being considered, some design features can be
16 identified at this time, including the following:
17

- 18 • Pre-disturbance surveys should be conducted within the area of direct effects
19 to determine the presence and abundance of special status species, including
20 those identified in Table 8.1.12.1-1. Disturbance to occupied habitats for these
21 species should be avoided or minimized to the extent practicable. If avoiding
22 or minimizing impacts to occupied habitats is not possible, translocation of
23 individuals from areas of direct effect, or compensatory mitigation of direct
24 effects on occupied habitats, could reduce impacts. A comprehensive
25 mitigation strategy for special status species that used one or more of these
26 options to offset the impacts of development should be developed in
27 coordination with the appropriate federal and state agencies.
28
- 29 • Avoiding or minimizing disturbance of dunes and sand flats in the area of
30 direct effects could reduce impacts on the arid tansy-aster.
31
- 32 • Avoiding or minimizing disturbance of agricultural and riparian habitats in the
33 area of direct effects could reduce impacts on the lowland leopard frog.
34
- 35 • Consultation with the USFWS and the AZGFD should be conducted to
36 address the potential for impacts on the Sonoran population of bald eagle, a
37 species listed as threatened under the ESA and CESA. Consultation would
38 identify an appropriate survey protocol, avoidance measures, and, if
39 appropriate, reasonable and prudent alternatives, reasonable and prudent
40 measures, and terms and conditions for incidental take statements.
41
- 42 • Coordination with the USFWS and AZGFD should be conducted to address
43 the potential for impacts on the Sonoran population of the desert tortoise, a
44 species under review for listing under the ESA. Coordination would identify
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an appropriate survey protocol and mitigation requirements, which may include avoidance, minimization, translocation, or compensation.

- Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and AZGFD.

If these SEZ-specific design features are implemented in addition to required programmatic design features, impacts on the special status and rare species could be reduced.

1 **8.1.13 Air Quality and Climate**

2
3
4 **8.1.13.1 Affected Environment**

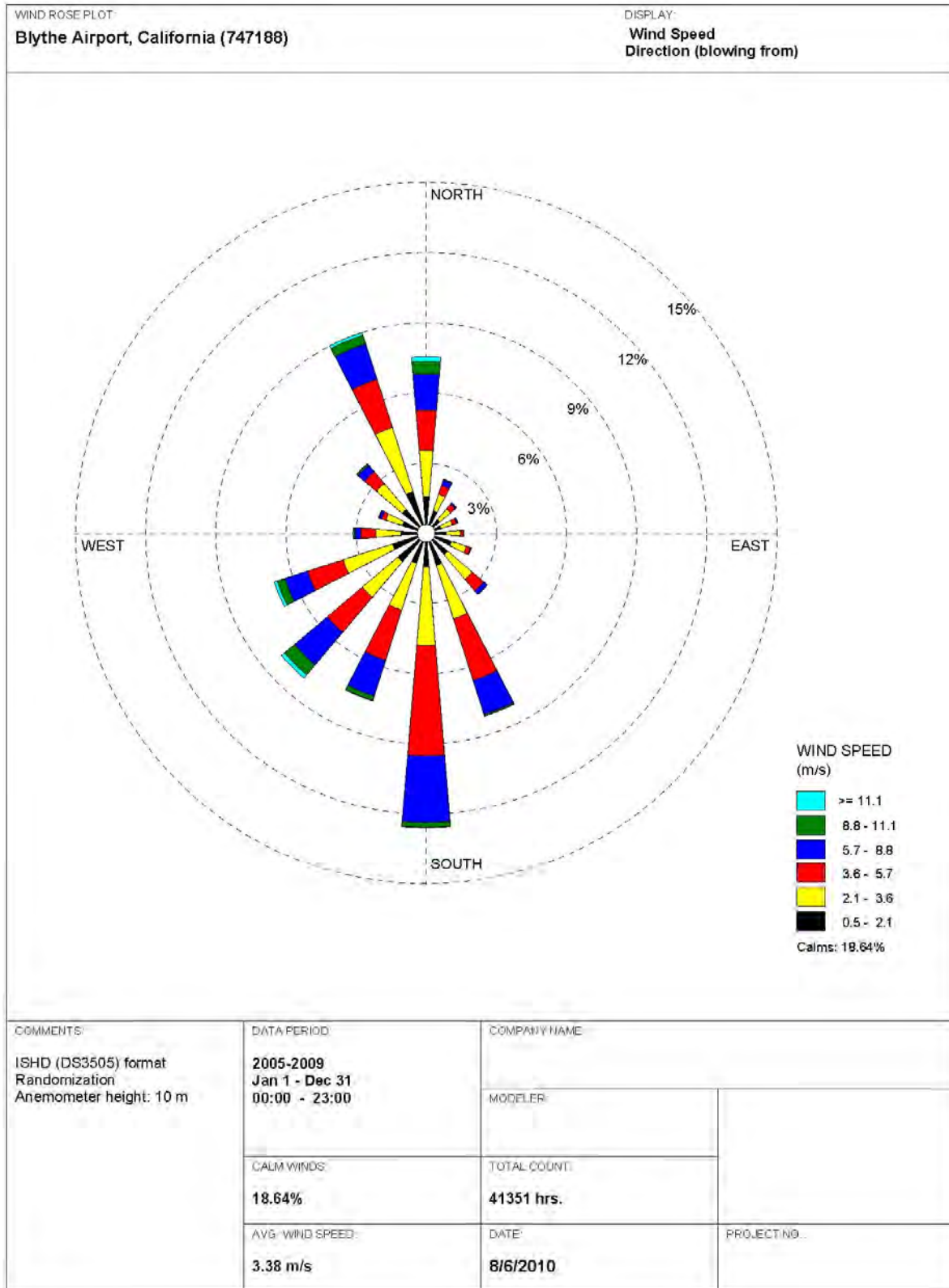
5
6
7 **8.1.13.1.1 Climate**

8
9 The proposed Brenda SEZ is in the south-central portion of La Paz County in western
10 Arizona. The SEZ is located on the middle of the valley floor at an average elevation of 1,180 ft
11 (360 m). Nearby mountain ranges are oriented northwest–southeast. The SEZ is located in the
12 northern portion of the Sonoran Desert, which covers the southwestern Arizona, southern
13 California, and northwestern Mexican states. The area experiences a desert-like arid climate,
14 characterized by hot summers, mild winters, light precipitation, a high rate of evaporation, low
15 relative humidity, abundant sunshine, and large temperature ranges (NCDC 2010a).
16 Meteorological data collected at the Blythe Airport in Blythe, California, about 45 mi (72 km)
17 west of the Brenda SEZ boundary, and at Bouse, about 16 mi (26 km) north–northwest, are
18 summarized below.

19
20 A wind rose from the Blythe Airport, based on data collected 33 ft (10 m) above the
21 ground over the 5-year period 2005 to 2009, is presented in Figure 8.1.13.1-1 (NCDC 2010b).⁶
22 During this period, the annual average wind speed at the airport was about 7.6 mph (3.4 m/s);
23 the prevailing wind direction was from the south (about 12.6% of the time) and secondarily
24 from the north–northwest (about 9.0% of the time). Wind directions alternated between north–
25 northwest (March, May, August, and October) and south (the rest of the months) throughout the
26 year. In California, general wind flow is from the west or northwest throughout the year, but
27 prevailing wind direction for a given site is influenced by local terrain. Wind speeds categorized
28 as calm (less than 1.1 mph [0.5 m/s]) occurred frequently (about one-fifth of the time) because of
29 the stable conditions caused by strong radiative cooling from late night to sunrise. Average wind
30 speeds by season were the highest in summer and fall at 7.8 mph (3.5 m/s); lower in winter at
31 7.4 mph (3.3 m/s); and lowest in spring at 7.2 mph (3.2 m/s).

32
33 Topography plays a large role in determining the temperature of any specific location in
34 Arizona. For the period 1932 to 2010, the annual average temperature at Bouse was 70.2°F
35 (21.2°C) (WRCC 2010). December was the coldest month, with an average minimum of 34.4°F
36 (1.3°C), and July was the warmest, with an average maximum of 108.1°F (42.3°C). In summer,
37 daytime maximum temperatures over 100°F (37.8°C) are common, and minimums are in the 70s.
38 The minimum temperatures recorded were below freezing ($\leq 32^{\circ}\text{F}$ [0°C]) during the colder
39 months (more than 12 days in December and January), but subzero temperatures were never
40 recorded. During the same period, the highest temperature, 123°F (50.6°C), was reached in
41

⁶ No meteorological stations to provide representative data are located near the SEZ. The Blythe Airport, the closest meteorological station from the Brenda SEZ was chosen to be representative of the SEZ, in part because the northwest–southeast orientation of valley and mountain ranges at the SEZ match closely with prevailing wind direction at the Blythe Airport.



1

2

3

FIGURE 8.1.13.1-1 Wind Rose at 33 ft (10 m) at the Blythe Airport in Blythe, California, 2005 to 2009 (Source: NCDC 2010b)

1 July 1958, and the lowest, 11°F (−11.7°C), in January 1974. In a typical year, about 173 days
2 had a maximum temperature of at least 90°F (32.2°C), while about 37 days had minimum
3 temperatures at or below freezing.
4

5 Throughout Arizona, precipitation patterns depend largely on elevation and the season
6 of the year. Rain occurs primarily in two distinct seasons—winter and summer monsoon season
7 (NCDC 2010a). For the 1932 to 2010 period, annual precipitation at Bouse averaged about
8 5.55 in. (14.1 cm) (WRCC 2010). On average, 26 days a year have measurable precipitation
9 (0.01 in. [0.025 cm] or higher). Seasonally, precipitation is the highest in winter followed by
10 summer, and the lowest in spring. Snowfall at Bouse is uncommon and limited to December. The
11 annual average snowfall at Bouse was about 0.1 in. (0.3 cm), and the highest monthly snowfall
12 recorded was 4 in. (10.2 cm) in December 1932.
13

14 The proposed Brenda SEZ is far from major water bodies (more than 140 mi [225 km])
15 to the Gulf of California). Severe weather events, such as floods, hail, and thunderstorm winds,
16 have been reported in La Paz County, which encompasses the Brenda SEZ (NCDC 2010c).
17

18 Flood conditions occur infrequently in Arizona, but occasional heavy storms during
19 summer thunderstorm season at times cause floods that do considerable local damage. Since
20 1994, 24 floods (mostly flash floods) have been reported in La Paz County, half of which
21 occurred in the nearby towns such as Vicksburg, Bouse, and Quartzsite. These floods caused
22 two deaths and considerable property and crop damages.
23

24 In La Paz County, eight hail events in total have been reported since 1997, but only one
25 of those caused minor crop damage. Hail measuring 1.75 in. (4.4 cm) in diameter was reported in
26 two incidents. In La Paz County, 51 thunderstorm wind events have been reported since 1983,
27 and those up to a maximum wind speed of 81 mph (36 m/s) occur primarily during the summer
28 and cause some property damage (NCDC 2010c).
29

30 No dust storm events were reported in La Paz County (NCDC 2010c). However, the
31 ground surface of the SEZ is covered primarily with loams to sandy loams (with gravelly loams
32 along the west side, about 30% of the site), which have moderate dust storm potential. On
33 occasion, high winds accompanied by thunderstorms and dry soil conditions could result in
34 blowing dust in La Paz County. Dust storms can deteriorate air quality and visibility and have
35 adverse effects on health, particularly for people with asthma or other respiratory problems.
36

37 Hurricanes and tropical storms formed off the coast of Central America and Mexico
38 weaken over the cold waters off the California coast. Accordingly, hurricanes rarely hit Arizona
39 through California. Historically, two tropical storms/depressions from the Gulf of California
40 passed within 100 mi (160 km) of the proposed Brenda SEZ (CSC 2010). No tornadoes were
41 reported in La Paz County (NCDC 2010c).
42
43
44

1 **8.1.13.1.2 Existing Air Emissions**

2
3 La Paz County has a few industrial emission sources
4 over the county, but their emissions are relatively small. No
5 emission sources are located around the proposed Brenda SEZ.
6 Several major roads exist in La Paz County, such as I-10, U.S.
7 60, U.S. 95, and State Routes 72 and 95. Thus, onroad mobile
8 source emissions are substantial compared with other sources in
9 La Paz County. Data on annual emissions of criteria pollutants
10 and VOCs in La Paz County are presented in Table 8.1.13.1-1
11 for 2002 (WRAP 2009). Emission data are classified into six
12 source categories: point, area (including fugitive dust), onroad
13 mobile, nonroad mobile, biogenic, and fire (wildfires,
14 prescribed fires, agricultural fires, structural fires). In 2002,
15 nonroad sources were major contributors to total sulfur dioxide
16 (SO₂) emissions (about 51%). Onroad sources were major
17 contributors to nitrogen oxides (NO_x) and carbon monoxide
18 (CO) emissions (about 73% and 45%, respectively,) and
19 secondary contributors to SO₂ emissions (about 34%). Biogenic
20 sources (i.e., vegetation—including trees, plants, and crops—
21 and soils) that release naturally occurring emissions contributed
22 secondarily to CO emissions (about 40%), and accounted for
23 most of the volatile organic compounds (VOC) emissions
24 (about 96%). Area sources accounted for about 91% of PM₁₀
25 and 70% of PM_{2.5}. In La Paz County, point and fire emissions
26 sources were minor contributors to criteria pollutants and
27 VOCs.

28
29 In 2010, Arizona is projected to produce about
30 116.6 MMt of *gross*⁷ carbon dioxide equivalent (CO_{2e})⁸
31 emissions, which is about 1.6% of total U.S. greenhouse gas
32 (GHG) emissions in 2007 (Bailie et al. 2005). Gross GHG
33 emissions in Arizona increased by about 77% from 1990 to 2010 because of Arizona’s rapid
34 population growth and attendant economic growth, compared to 16% growth in U.S. GHG
35 emissions during the 1990 to 2005 period. In 2005, electric use (about 40.0%) and transportation
36 (about 38.9%) were the primary contributors to gross GHG emission sources in Arizona. Fuel
37 use in the residential, commercial, and industrial (RCI) sectors combined accounted for about
38 15.4% of total state emissions. Arizona’s *net* emissions were about 109.9 MMt CO_{2e},
39 considering carbon sinks from forestry activities and agricultural soils throughout the state. The

TABLE 8.1.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in La Paz County, Arizona, Encompassing the Proposed Brenda SEZ, 2002^a

Pollutant ^b	Emissions (tons/yr) ^c
SO ₂	152
NO _x	4,911
CO	68,025
VOCs	178,905
PM ₁₀	3,196
PM _{2.5}	886

^a Includes point, area (including fugitive dust), onroad and nonroad mobile, biogenic, and fire emissions.

^b Notation: CO = carbon monoxide; NO_x = nitrogen oxides; PM_{2.5} = particulate matter with a diameter of ≤2.5 μm; PM₁₀ = particulate matter with a diameter of ≤10 μm; SO₂ = sulfur dioxide; and VOC = volatile organic compound.

^c To convert tons to kilograms, multiply by 907.

Source: WRAP (2009).

⁷ Excluding GHG emissions removed as a result of forestry and other land uses and excluding GHG emissions associated with exported electricity.

⁸ This is a measure used to compare the emissions from various GHGs on the basis of their global warming potential, defined as the cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas, CO₂. The CO_{2e} for a gas is derived by multiplying the mass of the gas by the associated global warming potential.

1 U.S. Environmental Protection Agency (EPA) (2009a) also estimated 2005 emissions in Arizona.
2 Its estimate of CO₂ emissions from fossil fuel combustion was 97.2 MMT, which was
3 comparable to the state's estimate. Electric power generation and transportation accounted for
4 about 51.8% and 38.8% of the CO₂ emissions total, respectively, while the residential,
5 commercial, and industrial (RCI) sectors accounted for the remainder (about 9.4%).
6
7

8 **8.1.13.1.3 Air Quality**

9

10 The State of Arizona has adopted the National Ambient Air Quality Standards (NAAQS)
11 for six criteria pollutants: sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO),
12 ozone (O₃), particulate matter (PM; PM₁₀ and PM_{2.5}), and lead (Pb) (ADEQ 2009; EPA 2010a).
13 The NAAQS for criteria pollutants are presented in Table 8.1.13.1-2.
14

15 La Paz County is located administratively within the Mohave-Yuma Intrastate Air
16 Quality Control Region (AQCR), along with Mohave and Yuma Counties. Currently, the area
17 surrounding the proposed SEZ is designated by the U.S. EPA as being in
18 unclassifiable/attainment of NAAQS for all criteria pollutants (Title 40, Part 81, Section 303 of
19 the *Code of Federal Regulations* [40 CFR 81.303]).
20

21 Because of La Paz County's low population density, it has no significant emission
22 sources of its own, only mobile emissions along major highways. Accordingly, ambient air
23 quality in La Paz County is relatively good, except for O₃ and possibly PM levels. The only
24 ambient air-monitoring station in La Paz County is at Alamo Lake State Park, which is about
25 37 mi (60 km) north-northeast of the SEZ. That station has collected only NO₂ and O₃ data. To
26 characterize ambient air quality around the SEZ, data from the three closest monitoring stations,
27 all in Maricopa County, were chosen. For CO and PM₁₀, concentration data from Buckeye,
28 which is located about 75 mi (121 km) east-southeast of the SEZ, are presented in
29 Table 8.1.13.1-2. For SO₂ and PM_{2.5}, highest concentrations at two monitoring stations in the
30 Phoenix area, which are located over 100 mi (161 km) east of the SEZ, are presented. No Pb
31 measurements have been made in the state of Arizona because of low Pb concentration levels
32 after the phaseout of leaded gasoline. The background concentrations of criteria pollutants at
33 these stations for the period 2004 to 2008 are presented in Table 8.1.13.1-2 (EPA 2010b).
34 Monitored concentration levels were lower than their respective standards (up to 10%), except
35 O₃, PM₁₀, and PM_{2.5}, which exceed their respective NAAQS. These criteria pollutants are of
36 regional concern in the area, because of high temperatures, abundant sunshine, and windblown
37 dust from occasional high winds and dry soil conditions,
38

39 The Prevention of Significant Deterioration (PSD) regulations (see 40 CFR 52.21), which
40 are designed to limit the growth of air pollution in clean areas, apply to a major new source or
41 modification of an existing major source within an attainment or unclassified area (see
42 Section 4.11.2.3). As a matter of policy, the EPA recommends that the permitting authority
43 notify the Federal Land Managers when a proposed PSD source would locate within 62 mi
44 (100 km) of a sensitive Class I area. Several Class I areas are located in Arizona and California,
45 but none is within 62 mi (100 km) of the proposed SEZ. The nearest is Joshua Tree National
46 Park (NP) in California (40 CFR 81.405), about 76 mi (122 km) west of the Brenda SEZ. This

TABLE 8.1.13.1-2 NAAQS and Background Concentration Levels Representative of the Proposed Brenda SEZ in La Paz County, Arizona, 2004 to 2008

Pollutant ^a	Averaging Time	NAAQS	Background Concentration Level	
			Concentration ^{b,c}	Measurement Location, Year
SO ₂	1-hour	75 ppb ^d	– ^e	–
	3-hour	0.5 ppm	0.013 ppm (2.6%)	Phoenix, Maricopa County, 2007
	24-hour	0.14 ppm	0.008 ppm (5.7%)	Phoenix, Maricopa County, 2004
	Annual	0.030 ppm	0.003 ppm (10%)	Phoenix, Maricopa County, 2004
NO ₂	1-hour	100 ppb ^f	–	–
	Annual	0.053 ppm	0.003 ppm (5.7%)	Alamo Lake State Park, La Paz County, 2006
CO	1-hour	35 ppm	1.6 ppm (4.6%)	Buckeye, Maricopa County, 2007
	8-hour	9 ppm	0.9 ppm (10%)	Buckeye, Maricopa County, 2005
O ₃	1-hour	0.12 ppm ^g	0.083 ppm (69%)	Alamo Lake State Park, La Paz County, 2007
	8-hour	0.075 ppm	0.076 ppm (101%)	Alamo Lake State Park, La Paz County, 2008
PM ₁₀	24-hour	150 µg/m ³	204 µg/m ³ (136%)	Buckeye, Maricopa County, 2008
	Annual	50 µg/m ³ ^h	53 µg/m ³ (106%)	Buckeye, Maricopa County, 2007
PM _{2.5}	24-hour	35 µg/m ³	42.3 µg/m ³ (121%)	Phoenix, Maricopa County, 2005
	Annual	15.0 µg/m ³	13.5 µg/m ³ (90%)	Phoenix, Maricopa County, 2006
Pb	Calendar quarter	1.5 µg/m ³	–	–
	Rolling 3-month	0.15 µg/m ³ ⁱ	–	–

^a Notation: CO = carbon monoxide; NO₂ = nitrogen dioxide; O₃ = ozone; Pb = lead; PM_{2.5} = particulate matter with a diameter of ≤2.5 µm; PM₁₀ = particulate matter with a diameter of ≤10 µm; SO₂ = sulfur dioxide.

^b Monitored concentrations are the second-highest for all averaging times less than or equal to 24-hour averages, except fourth-highest daily maximum for 8-hour O₃ and the 98th percentile for 24-hour PM_{2.5}; and arithmetic mean for annual SO₂, NO₂, PM₁₀, and PM_{2.5}.

^c Values in parentheses are background concentration levels as a percentage of NAAQS. Calculation of 1-hour SO₂ and NO₂ to NAAQS was not made, because no measurement data based on new NAAQS are available.

^d Effective August 23, 2010.

^e A dash indicates not applicable or not available.

^f Effective April 12, 2010.

^g The EPA revoked the 1-hour O₃ standard in all areas, although some areas have continuing obligations under that standard (“anti-backsliding”).

^h Effective December 18, 2006, the EPA revoked the annual PM₁₀ standard of 50 µg/m³ but annual PM₁₀ concentrations are presented for comparison purposes.

ⁱ Effective January 12, 2009.

Sources: ADEQ (2009); EPA (2010a,b).

1 Class I area is not located downwind of prevailing winds at the Brenda SEZ (Figure 8.1.13.1-1).
2 The next nearest Class I areas are beyond 124 mi (200 km) from the SEZ.
3
4

5 **8.1.13.2 Impacts**

6

7 Potential impacts on ambient air quality associated with a solar project would be of
8 most concern during the construction phase. Impacts on ambient air quality from fugitive dust
9 emissions resulting from soil disturbances are anticipated, but they would be of short duration.
10 During the operations phase, only a few sources with generally low levels of emissions would
11 exist for any of the four types of solar technologies evaluated. A solar facility would either not
12 burn fossil fuels or burn only small amounts during operation. (For facilities using heat transfer
13 fluids [HTFs], fuel could be used to maintain the temperature of the HTFs for more efficient
14 daily start-up.) Conversely, use of solar facilities to generate electricity would displace air
15 emissions that would otherwise be released from fossil fuel-fired power plants.
16

17 Air quality impacts shared by all solar technologies are discussed in detail in
18 Section 5.11.1, and technology-specific impacts are discussed in Section 5.11.2. Impacts
19 specific to the proposed Brenda SEZ are presented in the following sections. Any such impacts
20 would be minimized through the implementation of required programmatic design features
21 described in Appendix A, Section A.2.2, and through any additional mitigation applied.
22 Section 8.1.13.3 below identifies SEZ-specific design features of particular relevance to the
23 proposed Brenda SEZ.
24
25

26 **8.1.13.2.1 Construction**

27

28 The Brenda SEZ site has a relatively flat terrain; thus only a minimum number of site
29 preparation activities, perhaps with no large-scale earthmoving operations, would be required.
30 However, fugitive dust emissions from soil disturbances during the entire construction phase
31 would be a major concern because of the large areas that would be disturbed in a region that
32 experiences windblown dust problems. Fugitive dusts, which are released near ground level,
33 typically have more localized impacts than similar emissions from an elevated stack with
34 additional plume rise induced by buoyancy and momentum effects.
35
36

37 **Methods and Assumptions**

38

39 Air quality modeling for PM₁₀ and PM_{2.5} emissions associated with construction
40 activities was performed using the EPA-recommended AERMOD model (EPA 2009b). Details
41 for emissions estimation, the description of AERMOD, input data processing procedures, and
42 modeling assumption are described in Section M.13 of Appendix M. Estimated air
43 concentrations were compared with the applicable NAAQS levels at the site boundaries and
44 nearby communities and with Prevention of Significant Deterioration (PSD) increment levels at

1 nearby Class I areas.⁹ However, no receptors were modeled for PSD analysis at the nearest Class
2 I area, Joshua Tree NP, because it is about 76 mi (122 km) from the SEZ, which is over the
3 maximum modeling distance of 31 mi (50 km) for the AERMOD. Rather, several regularly
4 spaced receptors in the direction of the Joshua Tree NP were selected as surrogates for the PSD
5 analysis. For the Brenda SEZ, the modeling was conducted based on the following assumptions
6 and input:

- 7
- 8 • Uniformly distributed emissions of 3,000 acres (12.1 km²) over the Brenda
9 SEZ of 3,878 acres (15.7 km²),
- 10
- 11 • Surface hourly meteorological data from the Blythe Airport in California and
12 upper air sounding data from Tucson for the 2005-2009 period, and
- 13
- 14 • A regularly spaced receptor grid over a modeling domain of 62 × 62 mi
15 (100 × 100 km) centered on the proposed SEZ, and additional discrete
16 receptors at the SEZ boundaries.
- 17
- 18

19 **Results**

20

21 The modeling results for concentration increments and total concentrations (modeled plus
22 background concentrations) for both PM₁₀ and PM_{2.5} that would result from construction-related
23 fugitive emissions are summarized in Table 8.1.13.2-1. Maximum 24-hour PM₁₀ concentration
24 increments modeled to occur at the site boundaries would be an estimated 440 µg/m³, which
25 far exceeds the relevant standard level of 150 µg/m³. Total 24-hour PM₁₀ concentrations of
26 644 µg/m³ would also exceed the standard level at the SEZ boundary. In particular, highest
27 PM₁₀ concentrations among nearby residences are predicted to be about 175 µg/m³ at Pioneer,
28 located about 0.4 mi (0.6 km) south of the SEZ. However, high PM₁₀ concentrations would be
29 limited to the immediate areas surrounding the SEZ boundary and would decrease quickly with
30 distance.

31

32 Predicted maximum 24-hour PM₁₀ concentration increments would be about 20 µg/m³ at
33 Brenda, about 15 µg/m³ at Vicksburg, about 10 µg/m³ at Bouse, and about 5 µg/m³ at
34 Quartzsite. Annual average modeled concentration increments and total concentrations
35 (increment plus background) for PM₁₀ at the SEZ boundary would be about 70.7 µg/m³ and
36 124 µg/m³, respectively, which are higher than the NAAQS level of 50 µg/m³, which was
37 revoked by EPA in December 2006. Annual PM₁₀ increments would be much lower, about
38 15 µg/m³ at Pioneer, about 0.7 µg/m³ at Brenda, and 0.5 µg/m³ or lower at all other nearby
39 towns.

40

⁹ To provide a quantitative assessment, the modeled air impacts of construction were compared to the NAAQS levels and the PSD Class I increment levels. Although the Clean Air Act exempts construction activities from PSD requirements, a comparison with the Class I increment levels was used to quantify potential impacts. Only monitored data can be used to determine the attainment status. Modeled data are used to assess potential problems and as a consideration in the permitting process.

TABLE 8.1.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Brenda SEZ

Pollutant ^a	Averaging Time	Rank ^b	Concentration ($\mu\text{g}/\text{m}^3$)				Percentage of NAAQS	
			Maximum Increment ^b	Background ^c	Total	NAAQS	Increment	Total
PM ₁₀	24 hours	H6H	440	204	644	150	293	429
	Annual	– ^d	70.7	53.0	124	50	141	247
PM _{2.5}	24 hours	H8H	27.2	42.3	69.5	35	78	199
	Annual	–	7.1	13.5	20.6	15.0	47	137

^a PM_{2.5} = particulate matter with a diameter of $\leq 2.5 \mu\text{m}$; PM₁₀ = particulate matter with a diameter of $\leq 10 \mu\text{m}$.

^b Concentrations for attainment demonstration are presented. H6H = highest of the sixth-highest concentrations at each receptor over the 5-year period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-year period. For the annual average, multiyear averages of annual means over the 5-year period are presented. Maximum concentrations are predicted to occur at the site boundaries.

^c See Table 8.1.13.1-2.

^d A dash indicates not applicable.

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Total 24-hour PM_{2.5} concentrations would be $69.5 \mu\text{g}/\text{m}^3$ at the SEZ boundary, which is higher than the NAAQS level of $35 \mu\text{g}/\text{m}^3$; modeled increments contribute about two-thirds of background concentration to this total. The total annual average PM_{2.5} concentration would be $20.6 \mu\text{g}/\text{m}^3$, which is above the NAAQS level of $15.0 \mu\text{g}/\text{m}^3$. At Pioneer, predicted maximum 24-hour and annual PM_{2.5} concentration increments would be about of about 15 and $1.5 \mu\text{g}/\text{m}^3$, respectively.

10 Predicted 24-hour and annual PM₁₀ concentration increments at the surrogate receptors
11 for the nearest Class I Area—Joshua Tree NP in California—would be about 5.3 and $0.08 \mu\text{g}/\text{m}^3$,
12 or 67% and 2.0% of the PSD increments for the Class I area, respectively. These surrogate
13 receptors are more than 45 mi (72 km) from the Joshua Tree NP, and thus predicted
14 concentrations in Joshua Tree NP would be much lower than the above values (about 27% of
15 the PSD increments for 24-hour PM₁₀), considering the same decay ratio with distance.

16

17 In conclusion, predicted 24-hour and annual PM₁₀ and PM_{2.5} concentration levels could
18 exceed the NAAQS levels at the SEZ boundaries and in the immediate surrounding areas during
19 the construction of solar facilities. To reduce potential impacts on ambient air quality and in
20 compliance with programmatic design features, aggressive dust control measures would be used.
21 Potential air quality impacts on nearby communities would be much lower. Modeling indicates
22 that emissions from construction activities are not anticipated to exceed Class I PSD PM₁₀
23 increments at the nearest federal Class I area (Joshua Tree NP in California). Construction
24 activities are not subject to the PSD program, and the comparison provides only a screen for

1 gauging the magnitude of the impact. Accordingly, it is anticipated that impacts of construction
2 activities on ambient air quality would be moderate and temporary.

3
4 Emissions from the engine exhaust from heavy construction equipment and vehicles
5 could affect air-quality values (AQRVs) (e.g., visibility and acid deposition) at the nearby federal
6 Class I area. However, SO_x emissions from engine exhaust would be very low, because
7 programmatic design features would require ultra-low-sulfur fuel with a sulfur content of
8 15 ppm. NO_x emissions from engine exhaust would be primary contributors to potential impacts
9 on AQRVs. Construction-related emissions are temporary in nature and thus would cause some
10 unavoidable but short-term impacts.

11
12 Transmission lines within a designated ROW would be constructed to connect to the
13 nearest regional grid. A regional 161-kV transmission line is located about 19 mi (31 km) from
14 the proposed Brenda SEZ; thus construction of a transmission line over this relatively long
15 distance would likely be needed. Construction activities would result in fugitive dust emissions
16 from soil disturbance and engine exhaust emissions from heavy equipment and vehicles.
17 Construction time for the transmission line could be about two years. However, the site
18 of construction along the transmission line ROW would move continuously, thus no particular
19 area would be exposed to air emissions for a prolonged period. Therefore, potential air quality
20 impacts on nearby residences along the transmission line ROW, if any, would be minor and
21 temporary in nature.

22 23 24 **8.1.13.2.2 Operations**

25
26 Emission sources associated with the operation of a solar facility would include auxiliary
27 boilers; vehicle (commuter, visitor, support, and delivery) traffic; maintenance (e.g., mirror
28 cleaning and repair and replacement of damaged mirrors); and drift from cooling towers for the
29 parabolic trough or power tower technology if wet cooling was implemented (drift constitutes
30 low-level PM emissions). Some of these sources may need to comply with emissions standards,
31 including, but not limited to, the New Source Performance Standards (NSPS) for boilers
32 (40 CFR Part 60), the NSPS for stationary diesels (40 CFR 60 Subpart IIII), federal requirements
33 for nonroad diesels (40 CFR Part 89), and the National Emission Standards for Hazardous Air
34 Pollutants (NESHAP) for stationary reciprocating engines (40 CFR 63 Subpart ZZZZ). In
35 addition, given the typically small emissions, it is unlikely that PSD requirements would apply to
36 typical solar energy facilities.

37
38 The type of emission sources caused by and offset by operation of a solar facility are
39 discussed in Section M.13.4 of Appendix M.

40
41 Estimates of potential air emissions displaced by solar project development at the Brenda
42 SEZ are presented in Table 8.1.13.2-2. Total power generation capacity ranging from 345 to
43 620 MW is estimated for the Brenda SEZ for various solar technologies (see Section 8.1.2). The
44 estimated amount of emissions avoided for the solar technologies evaluated depends only on the
45 megawatts of conventional fossil fuel-generated power displaced, because a composite emission

TABLE 8.1.13.2-2 Annual Emissions from Combustion-Related Power Generation Avoided by Full Solar Development of the Proposed Brenda SEZ

Area Size (acres)	Capacity (MW) ^a	Power Generation (GWh/yr) ^b	Emissions Displaced (tons/yr; 10 ³ tons/yr for CO ₂) ^c			
			SO ₂	NO _x	Hg	CO ₂
3,878	345–620	604–1,087	465–837	716–1,289	0.007–0.012	513–924
Percentage of total emissions from electric power systems in Arizona ^d			0.87–1.6%	0.87–1.6%	0.87–1.6%	0.87–1.6%
Percentage of total emissions from all source categories in Arizona ^e			0.42–0.76%	0.20–0.35%	– ^f	0.48–0.86%
Percentage of total emissions from electric power systems in the six-state study area ^d			0.19–0.33%	0.19–0.35%	0.22–0.40%	0.20–0.35%
Percentage of total emissions from all source categories in the six-state study area ^e			0.10–0.18%	0.03–0.05%	–	0.06–0.11%

- ^a It is assumed that the SEZ would eventually have development on 80% of the lands and that a range of 5 acres (0.020 km²) per MW (for parabolic trough technology) to 9 acres (0.036 km²) per MW (power tower, dish engine, and PV technologies) would be required.
 - ^b A capacity factor of 20% was assumed.
 - ^c Composite combustion-related emission factors for SO₂, NO_x, Hg, and CO₂ of 1.54, 2.37, 2.2 × 10⁻⁵, and 1,700 lb/MWh, respectively, were used for the state of Arizona.
 - ^d Emission data for all air pollutants are for 2005.
 - ^e Emission data for SO₂ and NO_x are for 2002, while those for CO₂ are for 2005.
 - ^f A dash indicates not estimated.
- Sources: EPA (2009a,c); WRAP (2009).

1
2
3 factor per megawatt-hour of power by conventional technologies is assumed (EPA 2009c). It is
4 estimated that if the Brenda SEZ was fully developed, emissions avoided would range from
5 0.87 to 1.6% of total emissions of SO₂, NO_x, Hg, and CO₂ from electric power systems in the
6 state of Arizona (EPA 2009c). Avoided emissions would be up to 0.40% of total emissions from
7 electric power systems in the six-state study area. When compared with all source categories,
8 power production from the same solar facilities would displace up to 0.76% of SO₂, 0.35% of
9 NO_x, and 0.86% of CO₂ emissions in the state of Arizona (EPA 2009a; WRAP 2009). These
10 emissions would be up to 0.18% of total emissions from all source categories in the six-state
11 study area. Power generation from fossil fuel-fired power plants accounts for about 68% of the
12 total electric power generated in Arizona. The contribution of coal combustion is about 40%,
13 followed by natural gas combustion of about 28%, and nuclear generation of about 25%. Thus,
14 solar facilities to be built in the Brenda SEZ could reduce fuel-combustion-related emissions in

1 Arizona to some extent, but relatively less so than those built in other states with higher fossil
2 use rates.

3
4 As discussed in Section 5.11.1.5, the operation of associated transmission lines would
5 generate some air pollutants from activities such as periodic site inspections and maintenance.
6 However, these activities would occur infrequently, and the amount of emissions would be small.
7 In addition, transmission lines could produce minute amounts of O₃ and its precursor NO_x
8 associated with corona discharge (i.e., the breakdown of air near high-voltage conductors),
9 which is most noticeable for high-voltage lines during rain or very humid conditions. Since the
10 proposed Brenda SEZ is located in an arid desert environment, these emissions would be small,
11 and potential impacts on ambient air quality associated with transmission lines would be
12 negligible, considering the infrequent occurrences and small amount of emissions from corona
13 discharges.

14 15 16 **8.1.13.2.3 Decommissioning/Reclamation**

17
18 As discussed in Section 5.11.1.4, decommissioning/reclamation activities are similar to
19 construction activities but are on a more limited scale and of shorter duration. Potential impacts
20 on ambient air quality would be correspondingly less than those from construction activities.
21 Decommissioning activities would last for a short period, and their potential impacts would be
22 moderate and temporary. The same mitigation measures adopted during the construction phase
23 would also be implemented during the decommissioning phase (Section 5.11.3).

24 25 26 **8.1.13.3 SEZ-Specific Design Features and Design Feature Effectiveness**

27
28 No SEZ-specific design features are required. Limiting dust generation during
29 construction and operations at the proposed Brenda SEZ (such as increased watering frequency
30 or road paving or treatment) is a required design feature under BLM's Solar Energy Program.
31 These extensive fugitive dust control measures would keep off-site PM levels as low as possible
32 during construction.

1 **8.1.14 Visual Resources**

2
3
4 **8.1.14.1 Affected Environment**

5
6 The proposed Brenda SEZ is located in La Paz County in southwestern Arizona. The
7 western border of the SEZ is 32 mi (52 km) east of the California border. The SEZ occupies
8 3,878 acres (15.7 km²) and extends nearly 5 mi (8 km) east to west and approximately 3 mi
9 (5 km) north to south. The SEZ ranges in elevation from 1,110 ft (338 m) in the eastern portion
10 to 1,230 ft (375 m) in the western portion.

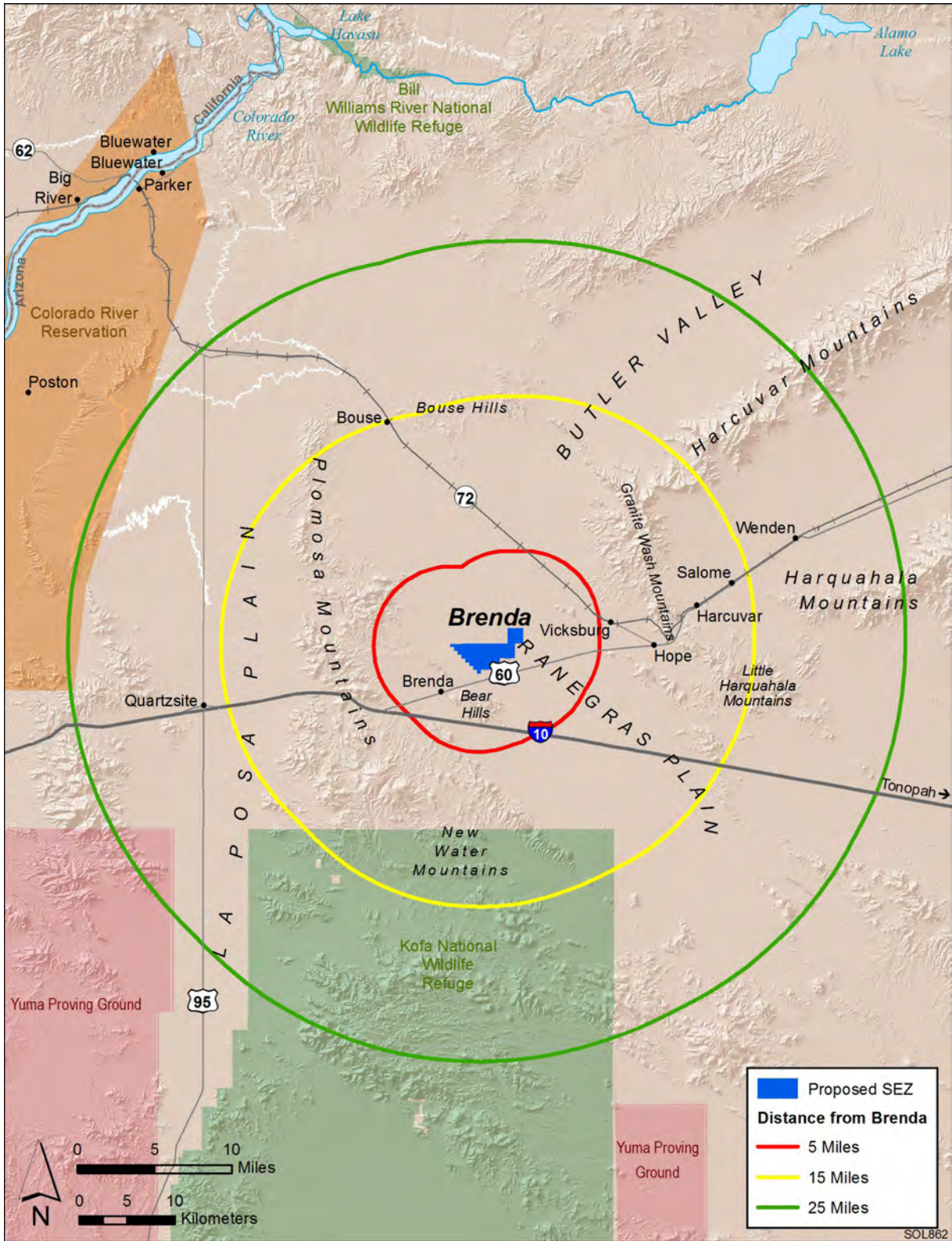
11
12 The SEZ is within the Sonoran basin and range physiographic province. The
13 physiographic province is typified by scattered low mountains and contains large tracts of
14 federally owned land, most of which is used for military training. The Sonoran basin and range
15 is slightly hotter than the Mojave basin and range and has large areas of palo verde-cactus shrub
16 and giant saguaro cactus.

17
18 The SEZ lies within the Ranegras Plain, bounded by mountain ranges to the east,
19 northeast, south, and west. The Bear Hills are located about 1.3 mi (2 km) southwest of the SEZ.
20 Granite Wash Mountains rise about 7.3 mi (12 km) northeast of the SEZ. These mountains
21 include peaks generally between 1,945 ft and 2,670 ft (593 and 814 m) in elevation. From the
22 northwest to the southeast, the broad Ranegras Plain extends more than 40 mi (64 km) and is
23 about 10 mi (16 km) wide. The location of the SEZ and surrounding mountain ranges are shown
24 in Figure 8.1.14.1-1.

25
26 The SEZ is located within a broad plain, with the strong horizon line and surrounding
27 mountain ranges being the dominant visual features. The surrounding mountains are generally
28 various shades of brown, from tan to dark brown. In contrast, gray gravels and tan sands
29 dominate the desert floor, which is dotted with the olive green of creosotebush and the deeper
30 greens of saguaro, ocotillo, barrel, and other cacti.

31
32 Vegetation within the SEZ is predominantly scrubland, with creosotebush and other low
33 shrubs dominating the Ranegras Plain within the SEZ. Vegetation is generally sparse in much of
34 the SEZ, with widely spaced shrubs growing on more or less barren gravel flats. The southwest
35 portion of the SEZ is more densely vegetated with various trees and shrubs in addition to cacti,
36 and in some areas, the vegetation is tall enough to partially screen views across the plain. The
37 saguaro and ocotillo add interesting vertical line and color contrasts where they occur, and the
38 rounded forms of trees add form and color contrast in some areas. During a September 2009 site
39 visit, the vegetation presented a range of greens (mostly olive green of creosotebushes, but with
40 deeper green trees and cacti in some locations) and some grays and tans (from lower shrubs).
41 Vegetation texture was medium to coarse, with generally low visual interest in areas dominated
42 by creosotebush and higher visual interest levels in areas containing cacti and trees.

43
44 No permanent surface water is present within the SEZ; however, the intermittent Bouse
45 Wash runs through the eastern portion of the SEZ, extending from northwest to southeast.
46



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FIGURE 8.1.14.1-1 Proposed Brenda SEZ and Surrounding Lands

1 Cultural disturbances visible within the SEZ include dirt roads and a corral and well on
2 the western edge of the SEZ. The SEZ is currently grazed. These cultural modifications generally
3 detract somewhat from the scenic quality of the SEZ; however, the SEZ is large enough that
4 from many locations within it, these features either are not visible or are so distant that they have
5 minimal effect on views. From most locations within the SEZ, the landscape is generally natural
6 in appearance, with little disturbance visible.
7

8 Off-site cultural disturbances visible from the SEZ include traffic on U.S. 60 and I-10,
9 0.5 mi (0.7 km) and 3.4 mi (5.4 km) south of the SEZ at the points of closest approach,
10 respectively; unpaved roads; residential and other structures along U.S. 60; agricultural lands
11 and associated structures; livestock corrals; and fences. In general, these cultural disturbances
12 detract from scenic values of the SEZ, primarily in the southern and eastern portions of the SEZ.
13

14 The general lack of topographic relief, water, and physical variety results in low scenic
15 value within the SEZ itself; however, because of the flatness of the landscape and the breadth of
16 the Ranegras Plain, the SEZ presents a vast panoramic landscape with sweeping views of the
17 surrounding mountains that add to the scenic values within the SEZ viewshed. In general, the
18 mountains appear to be devoid of vegetation, and their varied and irregular forms and various
19 shades of brown provide visual contrasts to the strong horizontal line, green vegetation, and gray
20 gravels and tan sands of the valley floor. In particular, the Bear Hills and the Plomosa Mountains
21 add significantly to scenic values when viewed from the nearby western portions of the SEZ. The
22 mountains surrounding the SEZ generally are visually pristine. Panoramic views of the SEZ and
23 the surrounding mountains are shown in Figures 8.1.14.1-2, 8.1.14.1-3, and 8.1.14.1-4.
24

25 The BLM conducted a visual resource inventory (VRI) for the SEZ and surrounding
26 lands in 2010; however, the VRI was not completed in time for the new data to be included in the
27 draft PEIS. The new VRI data will be incorporated into the analyses presented in the final PEIS.
28 The VRI evaluates BLM-administered lands based on scenic quality; sensitivity level, in terms of
29 public concern for preservation of scenic values in the evaluated lands; and distance from travel
30 routes or key observation points (KOPs). Based on these three factors, BLM-administered lands
31 are placed into one of four Visual Resource Inventory Classes, which represent the relative value
32 of the visual resources. Class I and II are the most valued; Class III represents a moderate value;
33 and Class IV represents the least value. Class I is reserved for specially designated areas, such as
34 national wildernesses and other congressionally and administratively designated areas where
35 decisions have been made to preserve a natural landscape. Class II is the highest rating for lands
36 without special designation. More information about VRI methodology is available in
37 Section 5.12 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

1



2 **FIGURE 8.1.14.1-2 Approximately 180° Panoramic View of the Proposed Brenda SEZ from West Central Portion of SEZ, Facing West**
3 **toward Bear Hills (Left of Center) and Plomosa Mountains (Center and Right)**

4

5

6



7 **FIGURE 8.1.14.1-3 Approximately 120° Panoramic View of the Proposed Brenda SEZ from Far Eastern Portion of SEZ Facing West**
8 **toward Granite Wash Mountains**

9

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11



12 **FIGURE 8.1.14.1-4 Approximately 120° Panoramic View of the Proposed Brenda SEZ from Far Western Boundary of SEZ Facing East-**
13 **Northeast with Plomosa Mountains at Left**

1 The *Record of Decision and Lake Havasu Field Office Approved Resource Management*
2 *Plan* (BLM 2007a) indicates that the SEZ is managed as visual resource management (VRM)
3 Class IV. VRM Class IV permits major modification of the existing character of the landscape.
4 More information about the BLM VRM program is available in Section 5.12 and in *Visual*
5 *Resource Management*, BLM Manual Handbook 8400 (BLM 1984).
6
7

8 **8.1.14.2 Impacts** 9

10 The potential for impacts from utility-scale solar energy development on visual resources
11 within the proposed Brenda SEZ and surrounding lands, as well as the impacts of related
12 developments (e.g., access roads and transmission lines) outside of the SEZ, is presented in
13 this section.
14

15 Site-specific impact assessment is needed to systematically and thoroughly assess visual
16 impact levels for a particular project. Without precise information about the location of a project,
17 a relatively complete and accurate description of its major components, and their layout, it is not
18 possible to assess precisely the visual impacts associated with the facility. However, if the
19 general nature and location of a facility are known, a more generalized assessment of potential
20 visual impacts can be made by describing the range of expected visual changes and discussing
21 contrasts typically associated with these changes. In addition, a general analysis can identify
22 sensitive resources that may be at risk if a future project is sited in a particular area. Detailed
23 information about the methodology employed for the visual impact assessment used in this PEIS,
24 including assumptions and limitations, is presented in Appendix M.
25

26 *Potential Glint and Glare Impacts.* Similarly, the nature and magnitude of potential glint-
27 and glare-related visual impacts for a given solar facility is highly dependent on viewer position,
28 sun angle, the nature of the reflective surface and its orientation relative to the sun and the
29 viewer, atmospheric conditions, and other variables. The determination of potential impacts from
30 glint and glare from solar facilities within a given proposed SEZ would require precise
31 knowledge of these variables and thus is not possible given the scope of the PEIS. Therefore, the
32 following analysis does not describe or suggest potential contrast levels arising from glint and
33 glare for facilities that might be developed within the SEZ; however, it should be assumed that
34 glint and glare are possible visual impacts from *any* utility-scale solar facility, regardless of size,
35 landscape setting, or technology type. The occurrence of glint and glare at solar facilities could
36 potentially cause large, though temporary, increases in brightness and visibility of the facilities.
37 The visual contrast levels projected for sensitive visual resource areas discussed in the following
38 analysis do not account for potential glint and glare effects; however, these effects would be
39 incorporated into a future site-and project-specific assessment that would be conducted for
40 specific proposed utility-scale solar energy projects. For more information about potential glint
41 and glare impacts associated with utility-scale solar energy facilities, see Section 5.12 of
42 this PEIS.
43
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1 **8.1.14.2.1 Impacts on the Proposed Brenda SEZ**
2

3 Some or all of the SEZ could be developed for one or more utility-scale solar energy
4 projects, utilizing one or more of the solar energy technologies described in Appendix F.
5 Because of the industrial nature and large size of utility-scale solar energy facilities, large visual
6 impacts on the SEZ would occur as a result of the construction, operation, and decommissioning
7 of solar energy projects. In addition, large impacts could occur at solar facilities utilizing highly
8 reflective surfaces or major light-emitting components (solar dish, parabolic trough, and power
9 tower technologies), with lesser impacts associated with reflective surfaces expected from PV
10 facilities. These impacts would be expected to involve major modification of the existing
11 character of the landscape and would likely dominate the views nearby. Additional, and
12 potentially large impacts would occur as a result of the construction, operation, and
13 decommissioning of related facilities, such as access roads and electric transmission lines. While
14 the primary visual impacts associated with solar energy development within the SEZ would
15 occur during daylight hours, lighting required for utility-scale solar energy facilities would be a
16 potential source of night sky pollution impacts, such as increased skyglow, light spillage, and
17 glare, both within the SEZ and on surrounding lands.
18

19 Common and technology-specific visual impacts from utility-scale solar energy
20 development, as well as impacts associated with electric transmission lines, are discussed in
21 Section 5.12 of this PEIS. Impacts would last throughout construction, operation, and
22 decommissioning, and some impacts could continue after project decommissioning. Visual
23 impacts resulting from solar energy development in the SEZ would be in addition to impacts
24 from solar energy development and other development that may occur on other public or private
25 lands within the SEZ viewshed, and are subject to cumulative effects. For discussion of
26 cumulative impacts, see Section 8.1.22.4.13 of this PEIS.
27

28 The changes described above would be expected to be consistent with BLM VRM
29 objectives for VRM Class IV, as seen from nearby KOPs. VRM Class IV is the current VRM
30 Class designation for the proposed Brenda SEZ. More information about impact determination
31 using the BLM VRM program is available in Section 5.12 and in *Visual Resource Contrast*
32 *Rating*, BLM Manual Handbook 8431-1 (BLM 1986b).
33

34 Implementation of the programmatic design features intended to reduce visual impacts
35 (described in Appendix A, Section A.2.2) would be expected to reduce visual impacts associated
36 with utility-scale solar energy development within the SEZ; however, the degree of effectiveness
37 of these design features could be assessed only at the site- and project-specific level. Given the
38 large scale, reflective surfaces, and strong regular geometry of utility-scale solar energy facilities
39 and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities
40 away from sensitive visual resource areas and other sensitive viewing areas would be the primary
41 means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures
42 would generally be limited but would be important to reduce visual contrasts to the greatest
43 extent possible.
44
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46

1 **8.1.14.2.2 Impacts on Lands Surrounding the Proposed Brenda SEZ**
2

3 Because of the large size of utility-scale solar energy facilities and the generally flat,
4 open nature of the proposed SEZ, lands outside the SEZ would be subjected to visual impacts
5 related to construction, operation, and decommissioning of utility-scale solar energy facilities.
6 The affected areas and extent of impacts would depend on a number of visibility factors and
7 viewer distance (for a detailed discussion of visibility and related factors, see Section 5.12).
8 A key component in determining impact levels is the intervisibility between the project and
9 potentially affected lands; if topography, vegetation, or structures screen the project from
10 viewer locations, there is no impact.
11

12 Preliminary viewshed analyses were conducted to identify which lands surrounding the
13 proposed SEZ are visible from the SEZ (see Appendix M for information on the assumptions
14 and limitations of the methods used). Four viewshed analyses were conducted, assuming four
15 different heights representative of project elements associated with potential solar energy
16 technologies: PV and parabolic trough arrays (24.6 ft [7.5 m]), solar dishes and power blocks
17 for CSP technologies (38 ft [11.6 m]), transmission towers and short solar power towers (150 ft
18 [45.7 m]), and tall solar power towers (650 ft [198.1 m]). Viewshed maps for the SEZ for all
19 four solar technology heights are presented in Appendix N.
20

21 Figure 8.1.14.2-1 shows the combined results of the viewshed analyses for all four solar
22 technologies. The colored segments indicate areas with clear lines of sight to one or more areas
23 within the SEZ and from which solar facilities within these areas of the SEZ would be expected
24 to be visible, assuming the absence of screening vegetation or structures and adequate lighting
25 and other atmospheric conditions. The light brown areas are locations from which PV and
26 parabolic trough arrays located in the SEZ could be visible. Solar dishes and power blocks for
27 CSP technologies would be visible from the areas shaded in light brown and the additional areas
28 shaded in light purple. Transmission towers and short solar power towers would be visible from
29 the areas shaded light brown, light purple, and the additional areas shaded in dark purple. Power
30 tower facilities located in the SEZ could be visible from areas shaded light brown, light purple,
31 and dark purple, and at least the upper portions of power tower receivers could be visible from
32 the additional areas shaded in medium brown.
33

34 For the following visual impact discussion, the tall solar power tower (650 ft [198.1 m])
35 and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds are shown in the figures and
36 discussed in the text. These heights represent the maximum and minimum landscape visibility
37 for solar energy technologies analyzed in this PEIS. Viewsheds for solar dish and CSP
38 technology power blocks (38 ft [11.6 m]) and for transmission towers and short solar power
39 towers (150 ft [45.7 m]) are presented in Appendix N. The visibility of these facilities would
40 fall between that for tall power towers and PV and parabolic trough arrays.
41
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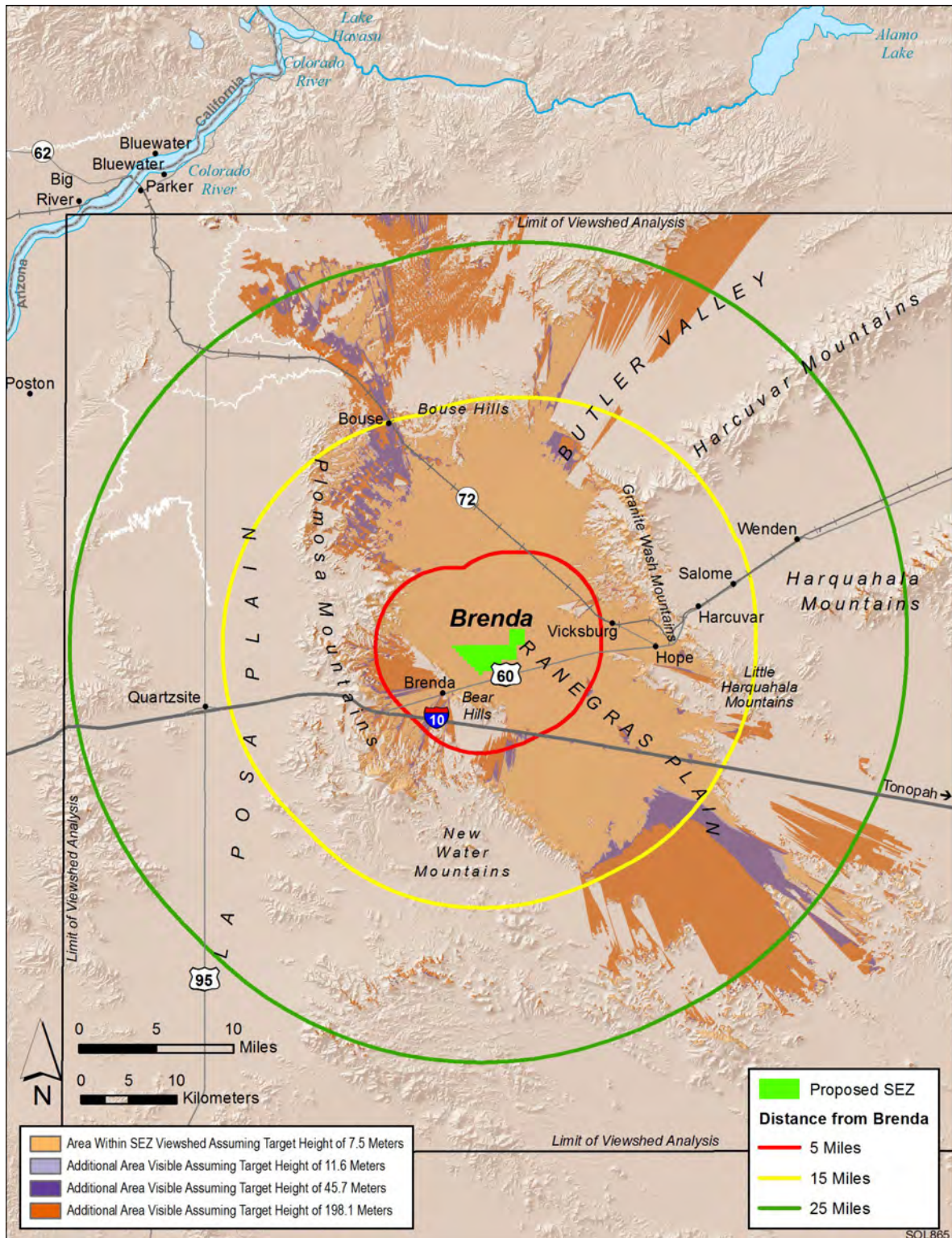


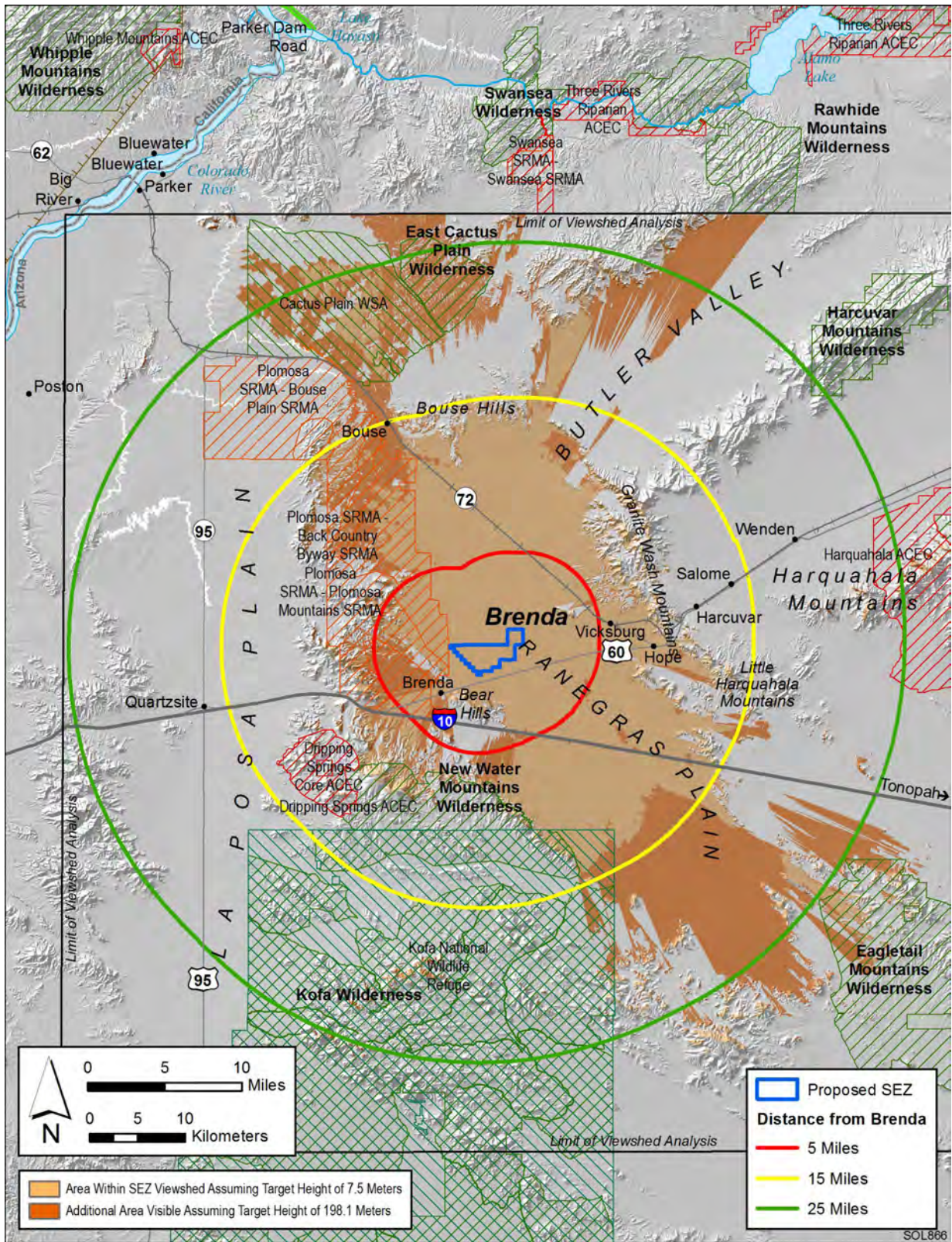
FIGURE 8.1.14.2-1 Viewshed Analyses for the Proposed Brenda SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

1 **Impacts on Selected Federal-, State-, and BLM-Designated Sensitive Visual**
2 **Resource Areas**

3
4 Figure 8.1.14.2-2 shows the results of a geographical information system (GIS) analysis
5 that overlays selected federal-, state-, and BLM-designated sensitive visual resource areas onto
6 the combined tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array
7 (24.6 ft [7.5 m]) viewsheds in order to illustrate which of these sensitive visual resource areas
8 could have views of solar facilities within the SEZ and therefore potentially would be subject to
9 visual impacts from those facilities. Distance zones that correspond with BLM’s VRM system-
10 specified foreground-middleground distance (5 mi [8 km]), background distance (15 mi
11 [24 km]), and a 25-mi (40-km) distance zone are shown as well, in order to indicate the effect of
12 distance from the SEZ on impact levels, which are highly dependent on distance.

13
14 The scenic resources included in the analyses were as follows:

- 15 • National Parks, National Monuments, National Recreation Areas, National
16 Preserves, National Wildlife Refuges, National Reserves, National
17 Conservation Areas, National Historic Sites;
 - 18 • Congressionally authorized Wilderness Areas;
 - 19 • Wilderness Study Areas;
 - 20 • National Wild and Scenic Rivers;
 - 21 • Congressionally authorized Wild and Scenic Study Rivers;
 - 22 • National Scenic Trails and National Historic Trails;
 - 23 • National Historic Landmarks and National Natural Landmarks;
 - 24 • All-American Roads, National Scenic Byways, State Scenic Highways, and
25 BLM- and USFS-designated scenic highways/byways;
 - 26 • BLM-designated Special Recreation Management Areas; and
 - 27 • ACECs designated because of outstanding scenic qualities.
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FIGURE 8.1.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds for the Proposed Brenda SEZ

1 Potential impacts on specific sensitive resource areas visible from and within 25 mi
2 (40 km) of the proposed Brenda SEZ are discussed below. The results of this analysis are
3 also summarized in Table 8.1.14.2-1. Further discussion of impacts on these areas is available
4 in Section 8.1.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and
5 Section 8.1.17 (Cultural Resources) of this PEIS.

6
7 The following visual impact analysis describes *visual contrast levels* rather than *visual*
8 *impact levels*. *Visual contrasts* are changes in the landscape as seen by viewers, including
9 changes in the forms, lines, colors, and textures of objects seen. A measure of *visual impact*
10 includes potential human reactions to the visual contrasts arising from a development activity,
11 based on viewer characteristics, including attitudes and values, expectations, and other
12 characteristics that are viewer- and situation-specific. Accurate assessment of visual impacts
13 requires knowledge of the potential types and numbers of viewers for a given development and
14 their characteristics and expectations; specific locations where the project might be viewed from;
15 and other variables that were not available or not feasible to incorporate in the PEIS analysis.
16 These variables would be incorporated into a future site- and project-specific assessment that
17 would be conducted for specific proposed utility-scale solar energy projects. For more discussion
18 of visual contrasts and impacts, see Section 5.12 of this PEIS.

GOOGLE EARTH™ VISUALIZATIONS

The visual impact analysis discussion in this section utilizes three-dimensional Google Earth™ perspective visualizations of hypothetical solar facilities placed within the SEZ. The visualizations include simplified wireframe models of a hypothetical solar power tower facility. The models were placed at various locations within the SEZ as visual aids for assessing the approximate size and viewing angle of utility-scale solar facilities. The visualizations are intended to show the apparent size, distance, and configuration of the SEZ, as well as the apparent size of a typical utility-scale solar power tower project and its relationship to the surrounding landscape, as viewed from potentially sensitive visual resource areas within the viewshed of the SEZ.

The visualizations are not intended to be realistic simulations of the actual appearance of the landscape or of proposed utility-scale solar energy projects. The placement of models within the SEZ did not reflect any actual planned or proposed projects within the SEZ, and did not take into account engineering or other constraints that would affect the siting or choice of facilities for this particular SEZ. The number of facility models placed in the SEZ does not reflect the 80% development scenario analyzed in the PEIS, but it should be noted that the discussion of expected visual contrast levels does account for the 80% development scenario. A solar power tower was chosen for the models because the unique height characteristics of power tower facilities make their visual impact potential extend beyond other solar technology types.

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TABLE 8.1.14.2-1 Selected Potentially Affected Sensitive Visual Resources within 25-mi (40-km) Viewshed of the Proposed Brenda SEZ, Assuming a Target Height of 650 ft (198.1 m)

Feature Type	Feature Name (Total Acreage)	Feature Area or Linear Distance ^a		
		Visible within 5 mi	Visible between	
			5 and 15 mi	15 and 25 mi
WAs	East Cactus Plain (14,318 acres)	0 acres	0 acres	9,888 acres (69%) ^b
	Kofa (547,739 acres)	0 acres	1,553 acres (0.3%)	5,019 acres (0.9%)
	New Water Mountains (24,628 acres)	0 acres	4,124 acres (17%)	0 acres
WSA	Cactus Plain (58,893 acres)	0 acres	0 acres	27,908 acres (47%)
Wildlife Refuge	Kofa (665,435 acres)	0 acres	7,122 acres (1%)	5,756 acres (0.9%)
SRMAs	Plomosa Backcountry Byway (5,987 acres)	0 acres	5,219 acres (87%)	152 acres (3%)
	Plomosa Bouse Plain (75,085 acres)	14,094 acres (19%)	22,272 acres (30%)	1,862 acres (3%)
	Plomosa Mountains (28,112 acres)	5,050 acres (18%)	5,085 acres (18%)	444 acres (2%)
ACECs designated for outstanding scenic values	Dripping Springs (11,081 acres)	0 acres	420 acres (4%)	0 acres
	Harquahala (77,201 acres)	0 acres	0 acres	139 acres (0.2%)

^a To convert acres to km², multiply by 0.004047. To convert miles to kilometers, multiply by 1.609.

^b Values in parentheses are percentage of feature acreage or length viewable.

Wilderness Areas

- *East Cactus Plain*—East Cactus Plain is a 14,318-acre (58-km²) congressionally designated wilderness area (WA) located 20 mi (32 km) north of the SEZ. Recreation such as backpacking, day hiking, sightseeing, horseback riding, and botanical and wildlife study are enhanced by varying dune topography, colors, and vegetation of the WA. Wilderness visitation is estimated at less than 200 visits annually.

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1 Within the WA, visibility of solar facilities within the SEZ would be limited
2 almost entirely to the upper portions of tall power towers. This area includes
3 about 9,888 acres (40 km²) in the 650-ft (198.1-m) viewshed, or 69% of the
4 total WA acreage, and 6 acres (0.02 km²) in the 24.6-ft (7.5-m) viewshed, or
5 0.04% of the total WA acreage. The visible area of the WA extends beyond
6 25 mi (40 km) from the northern boundary of the SEZ.
7

8 Most of the WA is about 100 to 200 ft (30 to 60 m) higher in elevation than
9 the SEZ, with a much smaller area 300 to 400 ft (90 to 120 m) higher than the
10 SEZ. At a distance of 20 to 25 mi (32 to 40 km), the vertical angle of view is
11 very low, and only the upper portions of sufficiently tall power towers would
12 be visible from most of the WA. Power tower receivers would appear as
13 points of light just above the southern horizon, against a backdrop of the Bear
14 Hills. At night, if sufficiently tall, power towers could have red or white
15 flashing hazard navigation lighting that could potentially be visible from the
16 WA. A very small area at the highest elevation within the WA could see lower
17 height facilities in favorable viewing conditions, but from the long distance
18 and very low viewing angle, the SEZ would occupy a very small portion of
19 the horizontal field of view. Solar energy development within the SEZ would
20 not be visible at all from large portions of the WA, and from the areas where it
21 could be seen, the expected visual contrast levels would be minimal.
22

- 23 • *Kofa*—Kofa is a 547,739-acre (2,217-km²) congressionally designated WA
24 located 14 mi (22 km) south of the SEZ. Wildlife management is the primary
25 function of the Kofa WA, and all other uses are secondary. At Kofa, hunting,
26 camping, rock climbing and repelling, hiking, wildlife observation,
27 photography, sightseeing, and environmental education activities are allowed
28 and considered compatible.
29

30 Within 25 mi (40 km) of the SEZ, solar energy facilities within the SEZ
31 could be visible from the northeastern portions of the WA (about 6,572 acres
32 [26.60 km²] in the 650-ft [198.1-m] viewshed, or 1% of the total WA acreage,
33 and 1,749 acres [7.078 km²] in the 25-ft [7.5-m] viewshed, or 0.3% of the
34 total WA acreage). The area of the WA with potential visibility of solar
35 facilities within the SEZ extends to 24 mi (38 km) from the southern boundary
36 of the SEZ.
37

38 Within the WA, visibility of the SEZ would be limited to the highest peaks in
39 the central portion of the WA and to the far northeastern corner and far eastern
40 side of the WA. Within the central portion of the WA, views of the SEZ
41 would be nearly completely screened by the intervening peaks of the Kofa
42 Mountains, the New Water Mountains, and the Bear Hills north of the Kofa
43 Mountains. Although the viewpoints are significantly elevated with respect to
44 the SEZ, the angle of view would be low and the topographic screening of the
45 SEZ would reduce its visibility to such an extent that it would occupy a very
46 small portion of the horizontal field of view. Where a clear line of sight to

1 power towers within the SEZ existed, the receivers of operating power towers
2 would appear as points of light just above the northern horizon. At night, if
3 sufficiently tall, power towers could have red or white flashing hazard
4 navigation lighting that could potentially be visible from the WA. As seen
5 from these viewpoints, expected visual contrasts from solar energy
6 development within the SEZ would be minimal.
7

8 In the far northeastern corner and eastern side of the WA, there would be
9 more open views of the SEZ, although the eastern end of the Bear Hills would
10 provide partial screening of the SEZ from most locations. Elevated viewpoints
11 within the WA could be as much as 800 ft (240 m) higher than the SEZ, but at
12 distances of 16 to 25 mi (26 to 40 km), the vertical angle of view would be
13 very low, and the partial topographic screening would reduce the visible
14 portion of the SEZ so that it would occupy a very small portion of the
15 horizontal field of view. Where solar facilities were visible within the SEZ,
16 they would be seen edge-on, which would minimize their apparent size, and
17 they would appear as short, thin lines just above the horizon and would
18 replicate the strong horizon line, which would tend to reduce visual contrast.
19 As seen from these viewpoints, expected visual contrasts from solar energy
20 development within the SEZ would be weak.
21

22 In general, as seen from viewpoints in the WA, visual contrasts associated
23 with solar facilities within the SEZ would depend on viewer location within
24 the WA, the numbers, types, sizes and locations of solar facilities in the SEZ,
25 and other project- and site-specific factors. Under the 80% development
26 scenario analyzed in the PEIS, where there were unobstructed views, contrasts
27 would be expected to be minimal to weak.
28

- 29 • *New Water Mountains*—New Water Mountains is a 24,628-acre (100-km²)
30 congressionally designated WA located 6.5 mi (10.5 km) at the point of
31 closest approach south of the SEZ. The *Yuma Field Office Record of Decision*
32 *and Approved Resource Management Plan* (BLM 2010c) states that recreation
33 within the New Water Mountains Wilderness is to include sustainable
34 opportunities for hiking, camping, hunting, and rock hounding.
35

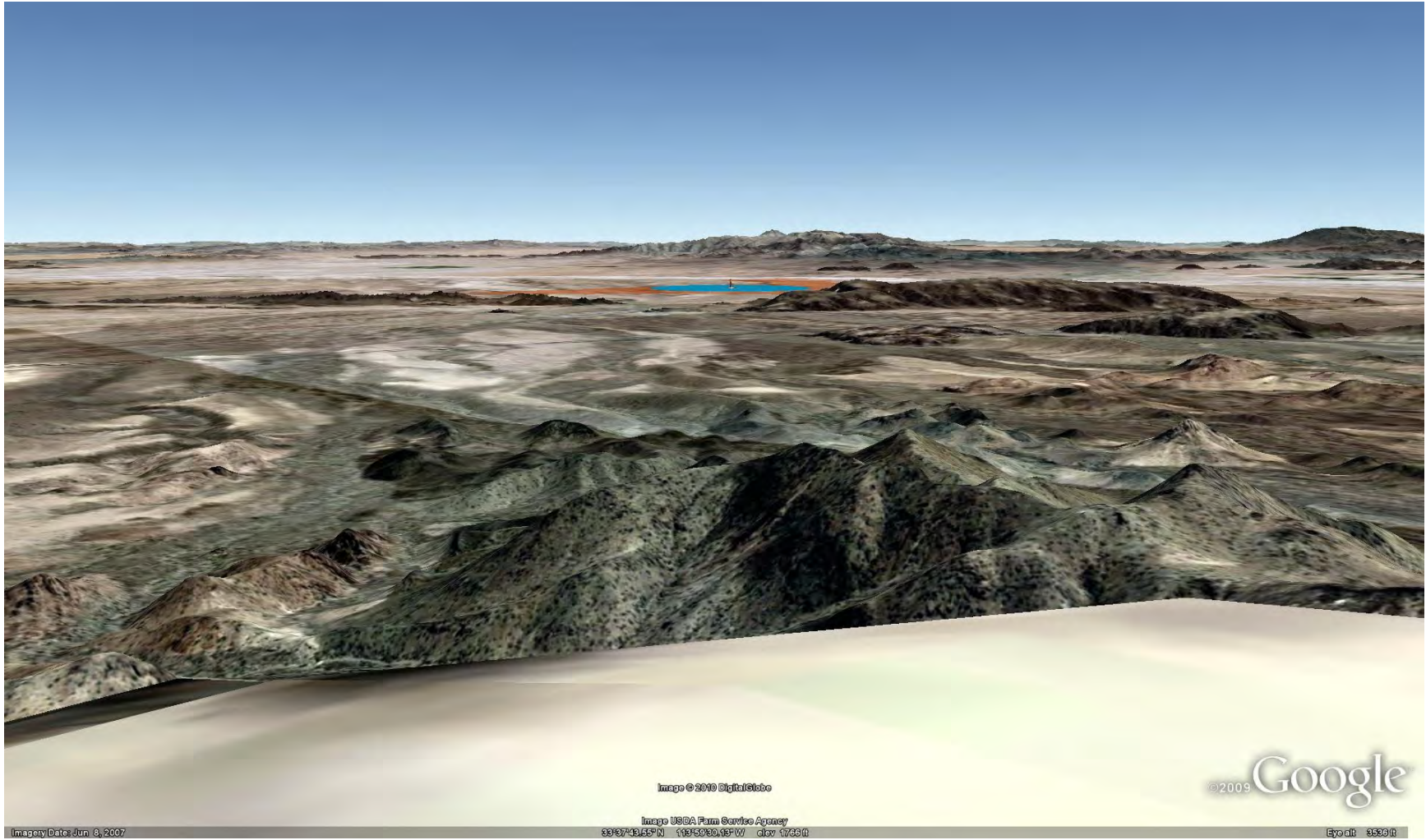
36 Within 25 mi (40 km), solar energy facilities within the SEZ could be visible
37 from the northern portions of the mountains within the WA. Areas of the WA
38 with potential visibility of solar facilities within the SEZ within the 25-mi
39 (40-km) radius of analysis total about 4,124 acres (16.69 km²) in the 650-ft
40 (198.1-m) viewshed, or 17% of the total WA acreage, and 3,016 acres
41 (12.21 km²) in the 24.6-ft (7.5-m) viewshed, or 12% of the total WA acreage.
42 The visible area of the WA extends to about 8.5 mi (13.7 km) from the
43 southern boundary of the SEZ.
44

1 Figure 8.1.14.2-3 is a Google Earth visualization of the SEZ as seen from the
2 western portion of Black Mesa, at nearly the highest elevation within the WA,
3 and with the clearest view of the SEZ of any area in the WA. The
4 visualization includes a simplified wireframe model of a hypothetical solar
5 power tower facility. The model was placed within the SEZ as a visual aid for
6 assessing the approximate size and viewing angle of utility-scale solar
7 facilities. The receiver tower depicted in the visualization is a properly scaled
8 model of a 459-ft (140-m) power tower with an 867-acre (3.5-km²) field of
9 12-ft (3.7-m) heliostats, representing about 100 MW of electric generating
10 capacity. One model was placed in the SEZ for this and other visualizations
11 shown in this section of this PEIS. In the visualization, the SEZ area is
12 depicted in orange, the heliostat field in blue.

13
14 The viewpoint in the visualization is about 1,300 ft (400 m) higher in
15 elevation than the SEZ, and about 9.2 mi (14.8 km) from the SEZ. The SEZ
16 is visible just above a large gap in the Bear Hills southwest of the SEZ, with
17 some screening of the eastern portion of the SEZ by intervening mountains.
18 The SEZ is far enough from the viewpoint that it would occupy a moderate
19 amount of the horizontal field of view. From this elevated location, the tops of
20 solar collector/reflector arrays within the SEZ would be visible: this would
21 make their large areal extent apparent and would tend to reveal their strong
22 regular geometry. Taller solar facility components, such as transmission
23 towers, could be visible projecting above the collector/reflector arrays. Power
24 towers within the SEZ might appear as bright points of light against the
25 backdrop of the plain, and the supporting tower structures would likely be
26 visible. At night, if sufficiently tall, power towers could have red or white
27 flashing hazard navigation lights that would likely be visible from this
28 location. Depending on project location within the SEZ, the types of solar
29 facilities and their designs, and other visibility factors, under the 80%
30 development scenario analyzed in this PEIS, weak to moderate visual
31 contrasts from solar energy facilities within the SEZ could be expected at this
32 location.

33
34 Most other locations within the WA would be at lower elevations, which
35 would be expected to decrease the vertical angle of view and increase the
36 likelihood and extent of screening of the SEZ, so that minimal to weak visual
37 contrast would be expected from solar energy development within the SEZ.

38
39 Visual contrasts associated with solar energy development within the SEZ
40 would depend on viewer location within the WA; solar facility type, size,
41 and location within the SEZ; and other visibility factors. Under the 80%
42 development scenario analyzed in this PEIS, minimal to weak levels of visual
43 contrast would be expected, with potentially moderate levels of contrast
44 expected for the highest elevations within the WA that have clear lines of
45 sight to the SEZ. The highest contrast levels would be expected for peaks in
46



1

2 **FIGURE 8.1.14.2-3 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power**
3 **Tower Wireframe Model, as Seen from Viewpoint on Black Mesa in the New Water Mountains WA**
4

1 the northern part of the WA, with lower contrasts expected for lower
2 elevations and viewpoints in the southern part of the WA.

3 4 5 ***Wilderness Study Area***

- 6
7 • *Cactus Plain*—The 58,893-acre (238-km²) Cactus Plain WSA is 18 mi
8 (29 km) northwest of the SEZ at the closest point of approach. According to
9 the *Record of Decision and Lake Havasu Field Office Approved Resource*
10 *Management Plan* (BLM 2007a), the WSA will be managed in a manner
11 that does not impair the suitability of the area for the future designation as
12 wilderness by Congress. About 27,908 acres (112.94 km²), or 47% of the
13 WSA, is within the 650-ft (198.1-m) viewshed of the SEZ, and 6,483 acres
14 (26.24 km²), or 11% of the WSA, is within the 24.6-ft (7.5-m) viewshed. The
15 portions of the WSA within the viewshed extend from the point of closest
16 approach to beyond 25 mi (40 km) from the SEZ.

17
18 The SEZ is visible from the Cactus Plain WSA through a gap between the
19 Plomosa Mountains and the Bouse Hills; however, most of the WSA is at a
20 slightly lower elevation than the SEZ, and at more than 18 mi (29 km) from
21 the SEZ, the angle of view to the SEZ would be very low. In addition, the far
22 western portion of the Bouse Hills provides partial screening of the SEZ from
23 portions of the WSA, so that the SEZ occupies a very small portion of the
24 horizontal field of view. Where solar facilities were visible within the SEZ,
25 they would be seen edge-on, and the collector/reflector arrays would be seen
26 as extremely thin and short lines just at the southern horizon. The receivers of
27 operating power tower within the SEZ would be seen as distant points of light
28 just above the southern horizon, against a sky backdrop. At night, if
29 sufficiently tall, power towers could have red or white flashing hazard
30 navigation lights that could be visible from the WSA. Under the 80%
31 development scenario analyzed in this PEIS, minimal visual contrast would be
32 expected for viewpoints in the Cactus Plain WSA.

33 34 35 ***National Wildlife Refuge***

- 36
37 • *Kofa*—The 665,435-acre (2,692.92-km²) Kofa NWR is 10 mi (16 km) south
38 of the SEZ at the closest point of approach. The refuge encompasses pristine
39 desert. About 12,878 acres (52.115 km²), or 2% of the NWR, is within the
40 650-ft (198.1-m) viewshed of the SEZ, and 5,573 acres (22.55 km²), or 0.8%
41 of the NWR, is within the 24.6-ft (7.5-m) viewshed. The portions of the NWR
42 within the viewshed extend from the point of closest approach to
43 approximately 23 mi (37 km) from the SEZ.

44
45 Within the NWR, visibility of the SEZ is limited to the highest peaks in the
46 north central portion of the NWR and to the far northeastern corner of the
47 NWR, with a few very small areas scattered along the peaks of the New Water

1 Mountains along the northern boundary of the NWR. Within the north central
2 portion of the NWR, views of the SEZ are nearly completely screened by
3 the intervening peaks of the Kofa Mountains, the New Water Mountains, and
4 the Bear Hills north of the Kofa Mountains. Although the viewpoints are
5 significantly elevated with respect to the SEZ, the angle of view is low and
6 the topographic screening of the SEZ reduces its visibility such that it would
7 occupy a very small portion of the horizontal field of view. Where a clear line
8 of sight to power towers within the SEZ existed, the upper portions of the
9 towers would appear as points of light just above the northern horizon. At
10 night, if sufficiently tall, power towers could have red or white flashing hazard
11 navigation lights that could be visible from the NWR. As seen from these
12 viewpoints, expected visual contrasts from solar energy development within
13 the SEZ would be minimal.

14
15 In the far northeastern corner of the NWR, there are more open views of the
16 SEZ, although the eastern end of the Bear Hills provides partial screening of
17 the SEZ from most locations. Elevated viewpoints within the NWR could be
18 more than 1,000 ft (300 m) higher than the SEZ, and at distances of 11 to
19 15 mi (18 to 24 km), the vertical angle of view is high enough that the tops
20 of solar collector/reflector arrays could be visible, making the large size and
21 the strong regular geometry of the arrays apparent. The partial topographic
22 screening of views of the SEZ by the Bear Hills would reduce the visible
23 portion of the SEZ, so that it would occupy a small portion of the horizontal
24 field of view.

25
26 In general, as seen from viewpoints in the Kofa NWR, visual contrasts
27 associated with solar facilities within the SEZ would depend on viewer
28 location within the NWR; the numbers, types, sizes and locations of solar
29 facilities in the SEZ; and other project- and site-specific factors. Under the
30 80% development scenario analyzed in the PEIS, where there were
31 unobstructed views, contrasts would be expected to be minimal to weak.

32 33 34 ***Special Recreation Management Area***

35
36 The Plomosa Mountains SRMA consists of three adjacent units. Information about the
37 units is presented separately below, but the impact analysis treats them as one SRMA.

- 38
39 • *Plomosa Backcountry Byway*—The Plomosa Backcountry Byway SRMA is a
40 BLM-designated SRMA located 9.2 mi (14.8 km) northwest of the SEZ at the
41 point of closest approach. It is a 5,987-acre (24.23-km²) scenic route
42 providing cultural/historical sightseeing, vistas, and photography.

43
44 The area of the SRMA within the 650-ft (198.1-m) viewshed of the SEZ
45 includes 5,371 acres (21.73 km²), or 90% of the total SRMA acreage. The
46 area of the SRMA within the 24.6-ft (7.5-m) viewshed of the SEZ includes
47 763 acres (3.09 km²), or 13% of the total SRMA acreage. The visible area

1 extends from the point of closest approach to almost 16 mi (26 km) into the
2 SRMA.

- 3
4 • *The Plomosa Bouse Plain*—The Plomosa Bouse Plain SRMA is a BLM-
5 designated SRMA located 0.2 mi (0.3 km) west of the western boundary of
6 the SEZ. It contains 75,085 acres (303.86 km²).

7
8 Approximately 38,228 acres (154.70 km²), or 51% of the SRMA, is within the
9 650-ft (198.1-m) viewshed of the SEZ, and 20,723 acres (83.863 km²) is in
10 the 24.6-ft (7.5-m) viewshed, or 28% of the total SRMA acreage. The visible
11 area of the SRMA extends approximately 18 mi (29 km) from the
12 northwestern boundary of the SEZ.

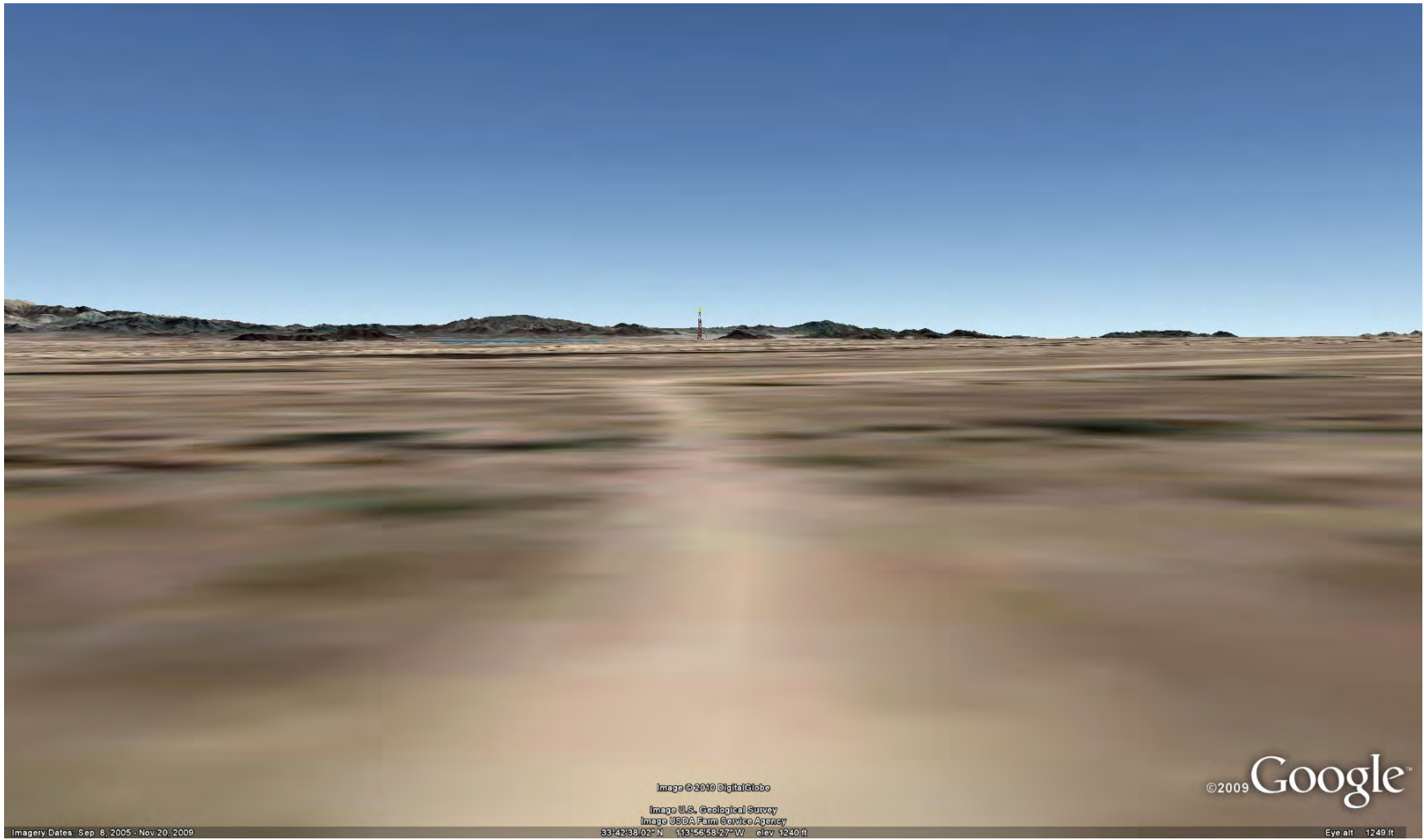
- 13
14 • *The Plomosa Mountains*—The Plomosa Mountains SRMA is a BLM-
15 designated SRMA located approximately 1 mi (1.6 km) west of the SEZ. It
16 encompasses 28,112 acres (113.77 km²).

17
18 Approximately 10,579 acres (42.812 km²), or 38% of the SRMA, is within the
19 650-ft (198.1-m) viewshed of the SEZ, and 7,029 acres (28.44 km²) is in the
20 24.6-ft (7.5-m) viewshed, or 25% of the total SRMA acreage. The visible area
21 of the SRMA extends approximately 6.5 mi (10.5 km) from the western
22 boundary of the SEZ.

23
24 Much of the area encompassed by the SRMA units is within the viewshed of
25 the SEZ. SRMA areas within the viewshed include portions of SRMA units
26 on the Ranegras Plain east of the Plomosa Mountains, and the eastern slopes
27 of the Plomosa Mountains. The southwestern and northwestern portions of the
28 collective SRMA are generally screened by the peaks within the eastern
29 portion of the Plomosa Mountains.

30
31 From those portions of the SRMA on the Ranegras Plain, although viewpoints
32 are closer to the SEZ, the angle of view is very low because the elevation of
33 the SRMA is similar to that of the SEZ. In the Plomosa Mountains,
34 viewpoints on mountain peaks can be more than 1,000 ft (300 m) higher in
35 elevation than the SEZ, so vertical angles of view are higher, though the
36 distances may be greater. Farther west in the SRMA, intervening mountains
37 tend to provide partial screening of views of the SEZ. Distances from
38 viewpoints in this portion of the SRMA are long enough that the angle of
39 view is low; this would cause solar facilities visible within the SEZ to appear
40 edge-on, reducing associated visual contrast levels.

41
42 Figure 8.1.14.2-4 is a Google Earth visualization of the SEZ as seen from a
43 nearby point on an unpaved road within the Plomosa Mountains unit of the
44 SRMA. The road is a major access road to the SRMA from the community
45 of Brenda, and the viewpoint is at the base of the Bear Hills, about 1.1 mi
46 (1.8 km) from the nearest point on the northwest corner of the SEZ, and at

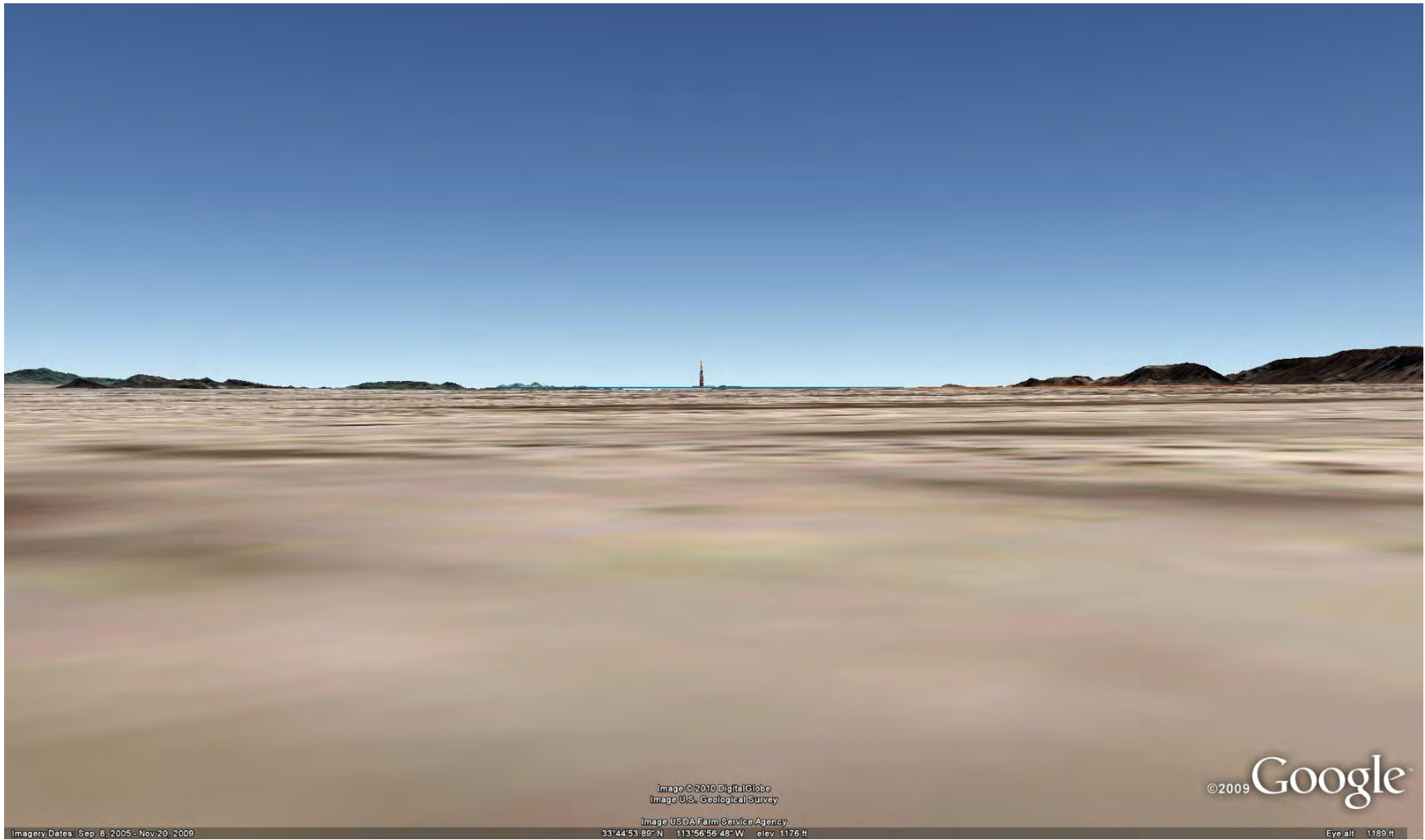


2 **FIGURE 8.1.14.2-4 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power**
3 **Tower Wireframe Model, as Seen from Viewpoint on Access Road from Brenda in Plomosa Mountains SRMA**

1 nearly the same elevation as the SEZ. The visualization suggests that from
2 this viewpoint, some of the ground surface of the SEZ would be screened by a
3 slight rise between the viewpoint and the SEZ, but the SEZ would still occupy
4 most of the horizontal field of view. At the short viewing distance, taller solar
5 facility components, such as power towers, buildings, cooling towers, and
6 plumes could project noticeably above solar collector/reflector arrays and
7 provide strong form, line, and color contrasts to the strongly horizontal
8 collector/reflector arrays as well as the surrounding mostly natural appearing
9 landscape. Details of project components could be discernable, likely
10 increasing texture contrasts. Receivers on operating power towers within the
11 SEZ could appear as brilliant nonpoint (i.e., having a cylindrical or
12 rectangular visible surface area) light sources during the day and, if more than
13 200 ft (61 m) tall, would have navigation warning lights at night that could be
14 very conspicuous from this location. Under the 80% development scenario
15 analyzed in this PEIS, strong visual contrast levels from solar energy
16 development within the SEZ would be expected at this viewpoint.
17

18 Figure 8.1.14.2-5 is a Google Earth visualization of the SEZ as seen from a
19 point on an unpaved road within the Bouse Plain unit of the SRMA, about
20 1.9 mi (3.0 km) north-northwest of the northwest corner of the SEZ. The
21 viewpoint elevation is about 35 ft (11 m) lower than the elevation of the
22 nearest point on the SEZ, so the angle of view is very low, and the collector/
23 reflector arrays of solar facilities within the SEZ would be viewed edge-on,
24 which would make their large areal extent and strong regular geometry less
25 apparent. The low angle of view would also cause them to appear as lines on
26 the horizon that would replicate the strong horizon line, tending to reduce
27 visual contrasts levels.
28

29 Depending on the technology type, ancillary facilities such as STGs,
30 transmission components, cooling towers, and buildings might project above
31 the collector/reflector arrays, and could contrast in form, line, and color with
32 the strongly horizontal arrays, as well as the surrounding mostly natural
33 appearing landscape. Plumes (if present) could add further contrasts. The SEZ
34 would occupy most of the horizontal field of view, and solar facilities within
35 the SEZ would likely strongly attract visual attention. Receivers on operating
36 power towers within the SEZ could appear as brilliant nonpoint light sources
37 during the day and, if more than 200 ft (61 m) tall, could have navigation
38 warning lights at night that could be very conspicuous from this location.
39 Under the 80% development scenario analyzed in this PEIS, strong visual
40 contrast levels from solar energy development within the SEZ would be
41 expected at this viewpoint.



1

FIGURE 8.1.14.2-5 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Viewpoint on Access Road from Brenda in Bouse Plain Unit of the Plomosa Mountains SRMA

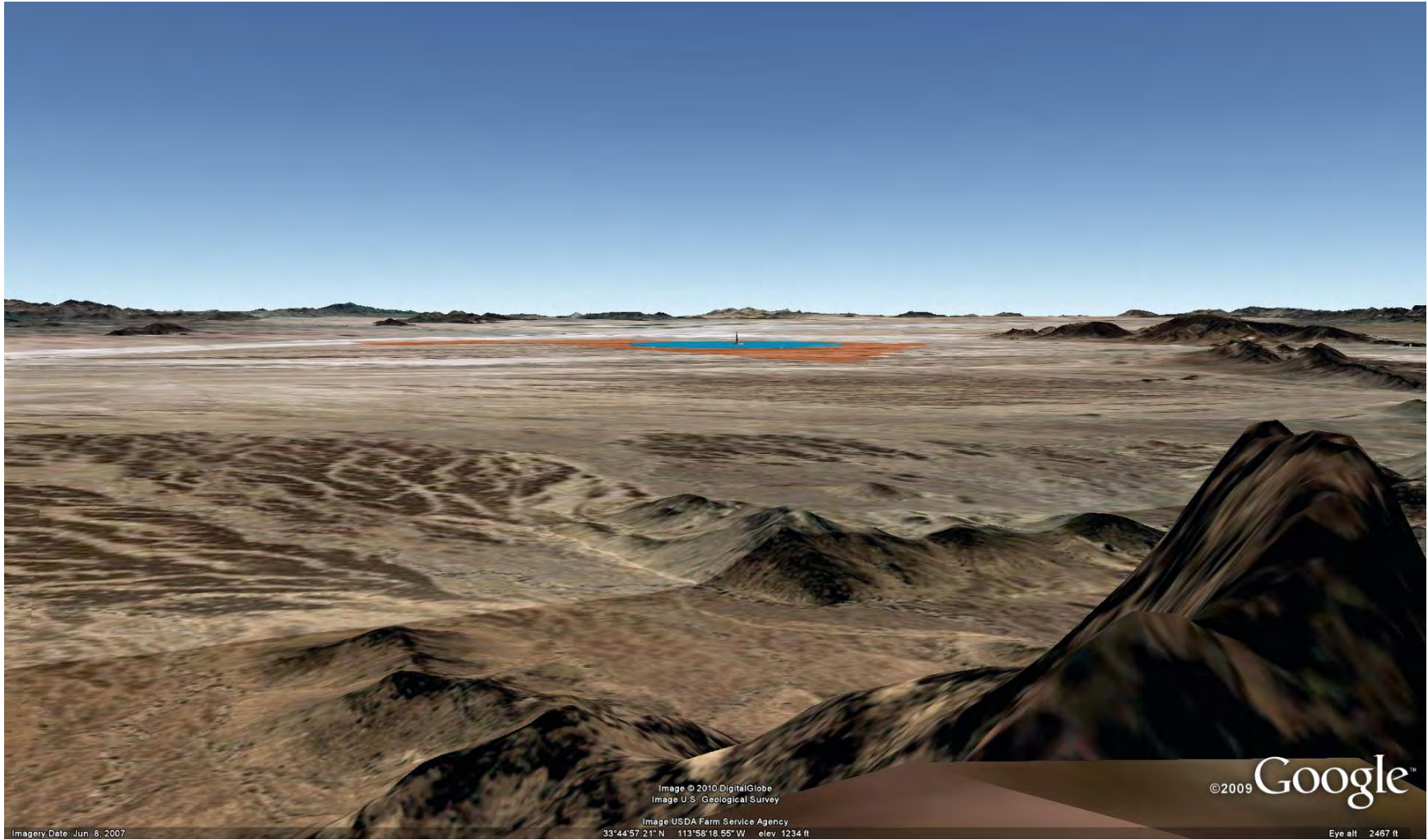
1 Figure 8.1.14.2-6 is a Google Earth visualization of the SEZ as seen from a
2 high peak within the Plomosa Mountains unit of the SRMA, about 5.1 mi
3 (8.2 km) northwest of the northwest corner of the SEZ. The viewpoint
4 elevation is about 1,200 ft higher than the elevation of the nearest point
5 on the SEZ, so the angle of view is relatively high and the tops of solar
6 collector/reflector arrays within the SEZ would be visible, which would tend
7 to reveal their strong regular geometry and make their large size more
8 apparent. The SEZ is far enough from the viewpoint that it would occupy a
9 moderate amount of the horizontal field of view.

10
11 Taller ancillary facilities, such as buildings, transmission structures, and
12 cooling towers; and plumes (if present) would likely be visible projecting
13 above the collector/reflector arrays. The ancillary facilities could create form
14 and line contrasts with the strongly horizontal, regular, and repeating forms
15 and lines of the collector/reflector arrays. Color and texture contrasts would
16 also be possible, but their extent would depend on the materials and surface
17 treatments utilized in the facilities.

18
19 Power towers within the SEZ might appear as very bright point light sources
20 against the backdrop of the plain, and the supporting tower structures would
21 be visible. If more than 200 ft (61 m) tall, power towers could have navigation
22 warning lights at night that could be conspicuous from this location.
23 Depending on project location within the SEZ, the types of solar facilities and
24 their designs, and other visibility factors, under the 80% development scenario
25 analyzed in this PEIS, strong visual contrasts from solar energy development
26 within the SEZ could be expected at this location.

27
28 The paved roadway through the Plomosa Backcountry Byway unit is largely
29 outside the lower height viewsheds of the SEZ, and from most points along
30 the roadway, only the upper portions of sufficiently tall power towers at
31 particular locations within the SEZ could be seen through narrow gaps in the
32 intervening Plomosa Mountains. The receivers on these power towers would
33 generally appear as bright lights just above the peaks and ridges of the
34 Plomosa Mountains, but for road travelers, the glimpses would be fleeting,
35 and associated impacts would be expected to be minimal. Where the roadway
36 left the Plomosa Mountains east of the mountains, the lower elevation and
37 longer distance to the SEZ would keep visibility of the SEZ and associated
38 impacts minimal.

39
40 In summary, for those portions of the SRMA east of the Plomosa Mountains
41 and within a few miles of the SEZ, strong visual contrasts associated with
42 solar energy development within the SEZ would be expected, while
43 viewpoints farther north in the unit would experience lower levels of contrast
44 as the distance to the SEZ increased. The high peaks in the eastern part of the
45 Plomosa Mountains with clear lines of sight to the SEZ could be subject to
46 moderate to strong impacts depending on distance to the SEZ. Other areas in



1

2 **FIGURE 8.1.14.2-6 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power**
3 **Tower Wireframe Model, as Seen from Viewpoint on a Peak in the Plomosa Mountains Unit of the Plomosa Mountains SRMA**
4

1 the SRMA would be subject to lower levels of contrast, and expected contrast
2 levels for the Plomosa Backcountry Byway unit would be minimal, due
3 primarily to very limited visibility of the SEZ.
4
5

6 *ACECs Designated for Outstandingly Remarkable Scenic Values*

7

- 8 • *Dripping Springs and Dripping Springs Core ACEC*—The 11,081-acre
9 (45-km²) Dripping Springs ACEC is located 9 mi (14.5 km) southwest of the
10 SEZ at the closest point of approach. The Dripping Springs ACEC contains a
11 combination of archaeological and historic features that are frequently visited
12 by the public. An oasis with rock outcroppings, sheer cliffs along the
13 backdrop of the area, exposed bedrock, and significant cholla stands add to
14 the scenic value of the ACEC. The Dripping Springs Core ACEC is located
15 11 mi (17.7 km) southwest of the SEZ, entirely within the Dripping Springs
16 ACEC.
17

18 Approximately 420 acres (1.7 km²), or 4% of the ACEC, is within the 650-ft
19 (198.1-m) viewshed of the SEZ, and 127 acres (0.5 km²) is in the 24.6-ft
20 (7.5-m) viewshed, or 1% of the total ACEC acreage. The visible area of the
21 ACEC extends approximately 12 mi (19.3 km) from the southern boundary
22 of the SEZ.
23

24 Visibility of the SEZ from the ACECs is limited to the highest elevations
25 within the ACECs. From these locations, views of the SEZ are partially
26 screened by peaks in the Plomosa Mountains relatively close to the ACECs
27 and/or by the Bear Hills close to the SEZ. At a distance of approximately
28 11 mi (18 km), the angle of view is low enough that solar facilities within the
29 SEZ would be seen nearly edge-on, which would decrease their apparent size
30 and tend to conceal the strong regular geometry of the collector/reflector
31 arrays. The solar arrays would appear as lines just over the Bear Hills and
32 would be partially screened by the Bear Hills. Where visible, the facilities
33 edge-on appearance would tend to replicate the line of the plain in which the
34 SEZ is located, reducing visual contrast. Receivers on power towers within
35 the SEZ could appear as bright points of light just above the Bear Hills during
36 the day, and if more than 200 ft (61 m) tall, could have navigation warning
37 lights at night that would likely be visible from the ACECs.
38

39 Viewpoints at lower elevations within the ACECs would have slightly lower
40 viewing angles, and would also be subject to greater screening by intervening
41 terrain, and thus lower levels of visual contrast from solar energy development
42 within the SEZ would be expected. Overall, under the 80% development
43 scenario analyzed in this PEIS, minimal to weak levels of visual contrast for
44 viewpoints within the Dripping Springs and Dripping Springs Core ACEC
45 would be expected.
46

- 1 • *Harquahala*—The 77,201-acre (312.42-km²) Harquahala ACEC is located 23
2 mi (37 km) east of the SEZ at the closest point of approach. The 5,691-ft
3 (1,735-m) high Harquahala Peak, the highest point in southwest Arizona,
4 provides a vast panorama of surrounding desert and distant mountain ranges
5 and is accessible via the Harquahala Mountain Summit Road in the ACEC,
6 although the summit itself is not within the SEZ 25-mi (40-km) viewshed.
7

8 Approximately 139 acres (0.563 km²), or 0.2% of the ACEC, is within the
9 650-ft (198.1-m) viewshed of the SEZ, and 74 acres (0.30 km²) is in the 24.6-
10 ft (7.5-m) viewshed, or 0.1% of the total ACEC acreage. The visible area of
11 the ACEC extends approximately 12 mi (19 km) from the southern boundary
12 of the SEZ.
13

14 Visibility of solar facilities within the SEZ would be limited to the crest of a
15 ridge running southwest to northeast across the ACEC. From the northwest
16 side of this ridgeline, much of the SEZ is screened either by mountains in the
17 Harquahala or Little Harquahala mountain ranges relatively close to the
18 viewpoint, or by the Granite Wash Mountains close to the SEZ. At a distance
19 between 23 and 25 mi (37 and 40 km) from the SEZ, the vertical angle of
20 view is very low, and with the topographic screening, the SEZ occupies a very
21 small portion of the horizontal field of view. If a clear line of sight to power
22 towers within the SEZ existed, they would appear as distant points of light just
23 above the peaks of the Little Harquahala Mountains during the day, and if
24 more than 200 ft (61 m) tall, could have navigation warning lights at night that
25 would likely be visible from the ACECs. Under the 80% development
26 scenario analyzed in this PEIS, visual contrasts from solar energy
27 development within the SEZ would be expected to be minimal.
28

29 Additional scenic resources exist at the national, state, and local levels, and impacts may
30 occur on both federal and nonfederal lands, including sensitive traditional cultural properties
31 important to Tribes. Note that in addition to the resource types and specific resources analyzed
32 in this PEIS, future site-specific NEPA analyses would include state and local parks, recreation
33 areas, other sensitive visual resources, and communities close enough to the proposed project to
34 be affected by visual impacts. Selected other lands and resources are included in the discussion
35 below.
36

37 In addition to impacts associated with the solar energy facilities themselves, sensitive
38 visual resources could be affected by other facilities that would be built and operated in
39 conjunction with the solar facilities. With respect to visual impacts, the most important
40 associated facilities would be access roads and transmission lines, the precise location of which
41 cannot be determined until a specific solar energy project is proposed. Currently, no suitable
42 transmission line is within the proposed SEZ, so construction and operation of a transmission
43 line outside the proposed SEZ would be required, and construction of transmission lines within
44 the SEZ to connect facilities to the existing line would also be required. Note that depending on
45 project- and site-specific conditions, visual impacts associated with access roads, and particularly
46 with transmission lines, could be large. Detailed information about visual impacts associated

1 with transmission lines is presented in Section 5.7.1. A detailed site-specific NEPA analysis
2 would be required to determine visibility and associated impacts precisely for any future solar
3 projects, based on more precise knowledge of facility location and characteristics.
4

6 **Impacts on Selected Other Lands and Resources**

7
8

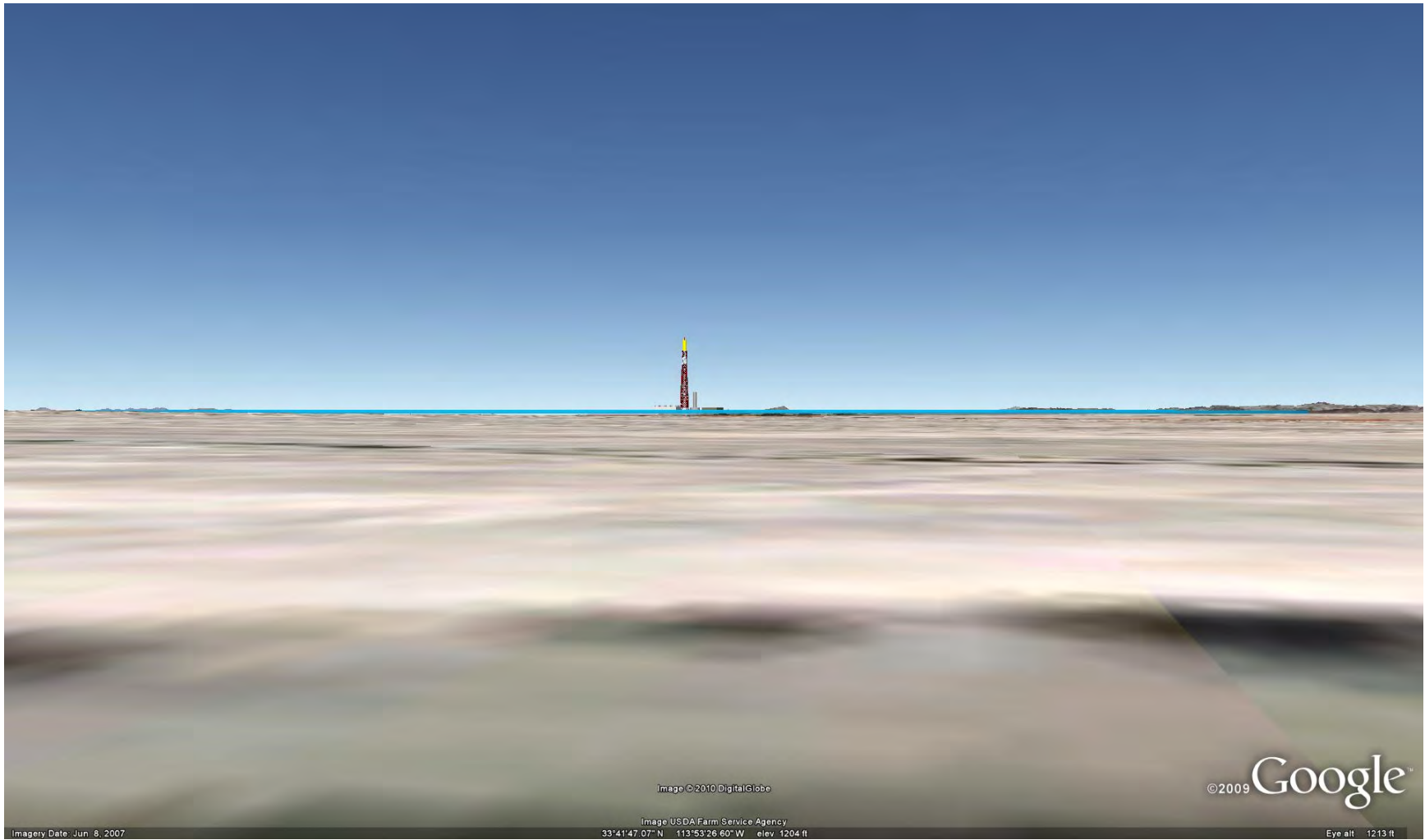
9 **U.S. 60.** U.S. 60 runs parallel to the southern boundary of the Brenda SEZ, at a distance
10 of about 0.4 mi (0.7 km) at the point of closest visible approach. The AADT value for U.S. 60 in
11 the vicinity of the SEZ is about 1,500 vehicles (ADOT 2010), although traffic would increase
12 slightly as a result of solar energy development within the SEZ. About 20 mi (32 km) of U.S. 60
13 is within the SEZ viewshed. About 13.4 mi (21.6 km) of U.S. 60 is within the 5-mi (8-km)
14 viewshed of the SEZ; 5 mi (8 km) is the limit of the BLM VRM program's foreground-
15 middleground distance.
16

17 Solar facilities within the SEZ would be in full view for westbound U.S. 60 travelers. The
18 SEZ would come into view about 1.2 mi (1.9 km) east of Hope and about 9.6 mi (15.5 km) from
19 the SEZ, after turning west while descending a pass in the Harquahala Mountains. At highway
20 speeds, the SEZ would be in view for about 9 minutes before travelers would pass directly south
21 of the SEZ on U.S. 60.
22

23 Because of the distance to the SEZ and low viewing angle, solar facilities within the SEZ
24 would create weak levels of visual contrast after first coming into view, but contrast levels would
25 reach moderate levels after just a few minutes. The SEZ would be in view directly in front of
26 westbound vehicles. At 4.6 mi (7.4 km) from the SEZ, the road would turn slightly south so that
27 it would point slightly south of the SEZ, and the SEZ would appear to move slightly to the right
28 as vehicles rounded the curve. Visual contrast from solar facilities within the SEZ would quickly
29 reach strong levels as vehicles approached the point of closest approach of U.S. 60 to the SEZ.
30

31 Figure 8.1.14.2-7 is a Google Earth visualization of the SEZ (highlighted in orange) as
32 seen from U.S. 60 approximately 0.5 mi (0.8 km) from the southern boundary of the SEZ, near
33 the point of closest approach. From this location, solar facilities within the SEZ would be seen
34 edge-on, and they would repeat the strong line of the horizon; this would tend to reduce visual
35 contrast. However, the SEZ is close enough that it would occupy more than the full horizontal
36 field of view, and viewers would have to turn their heads to encompass the entire SEZ. Solar
37 facilities within the SEZ would likely strongly command visual attention and would be expected
38 to dominate views from U.S. 60 at this location.
39

40 Because the road is less than 0.5 mi (0.8 km) from the SEZ at this viewpoint, strong
41 visual contrasts would be expected, depending on solar project characteristics and location
42 within the SEZ. Details of collector array and other structures could be visible, and there would
43 be strong contrasts of light and shadows falling between the collectors. Ancillary facilities taller
44 than the solar collector/reflector arrays for a given facility could add strong form, line, color, and
45 texture contrasts with the strongly horizontal arrays, and any visible plumes could be prominent,
46 depending on lighting conditions. Views to the north of the SEZ could be completely or partially



1

FIGURE 8.1.14.2-7 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on U.S. 60

2

3

4

5

1 screened by solar facilities, depending on the layout of those facilities within the SEZ. At night,
2 facility lighting could be obvious and a potential source of light spill and glare.

3
4 Depending on lighting conditions, the solar technologies present, facility layout, and
5 mitigation measures employed, the presence of large numbers of reflective surfaces very close to
6 the roadway could potentially distract drivers and/or impair views toward the facilities. These
7 potential impacts could be reduced by siting reflective components away from the byway,
8 employing various screening mechanisms, and adjusting the mirror operations to reduce potential
9 impacts. However, because of their height, power tower receivers located close to the roadway
10 could be difficult to screen.

11
12 If power tower facilities in the SEZ were located close to the road, the receivers could
13 appear as brilliant non-point light sources atop clearly discernable tower structures as viewed
14 from the road and, if sufficiently close to the road, would likely strongly attract views, although
15 they might be difficult for some people to look at for extended periods. Also, during certain
16 times of the day from certain angles, sunlight on dust particles in the air might result in the
17 appearance of light streaming down from the tower.

18
19 Eastbound travelers on U.S. 60 would have a much briefer and very different visual
20 experience than those just described for westbound travelers. The western terminus of U.S. 60 is
21 the I-10 interchange just west of Brenda and approximately 6.3 mi (10.1 km) west-southwest of
22 the SEZ. The SEZ would be partially visible at that point, but weak levels of visual contrast
23 would be expected because of partial screening of the SEZ by the Bear Hills. The SEZ would
24 be partially visible through a narrow gap in the Bear Hills directly northeast of Brenda. At the
25 interchange, the width of the gap is insufficient to permit a view of the entire SEZ from U.S. 60,
26 but because U.S. 60 passes directly through the gap, the apparent width of the gap would
27 increase as travelers approached Brenda. As travelers passed through Brenda and the Bear Hills
28 gap just east of Brenda, the view of the Ranegras Plain and the SEZ would open up, and
29 because the distance to the SEZ from the gap is about 2 mi (3.2 km), solar facilities within the
30 SEZ would be in full view and likely to cause strong visual contrasts for travelers on U.S. 60.

31
32 Figure 8.1.14.2-8 is a Google Earth visualization of the SEZ (highlighted in orange) as
33 seen from U.S. 60 just east of Brenda. Visual contrasts from solar energy development within
34 the SEZ as seen from this viewpoint would depend on solar facility type, size, and location
35 within the SEZ, but contrasts would likely peak at strong levels as eastbound travelers closely
36 approached and passed the south side of the SEZ.

37
38 In summary, visual contrasts associated with solar energy development within the SEZ
39 would be highly dependent on viewer location on U.S. 60; solar facility type, size, and location
40 within the SEZ; and other visibility factors. Under the 80% development scenario analyzed in
41 this PEIS, weak to strong visual contrast levels would be expected.

42
43
44 **Interstate 10.** I-10 passes within 3.3 mi (5.3 km) and is in the viewshed of the SEZ
45 for about 20 mi (32 km). The AADT value for I-10 in the vicinity of the SEZ is about
46 18,000 vehicles (ADOT 2010). About 5 mi (8 km) of I-10 is within the 5-mi (8-km) viewshed



1

FIGURE 8.1.14.2-8 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on U.S. 60 East of Brenda

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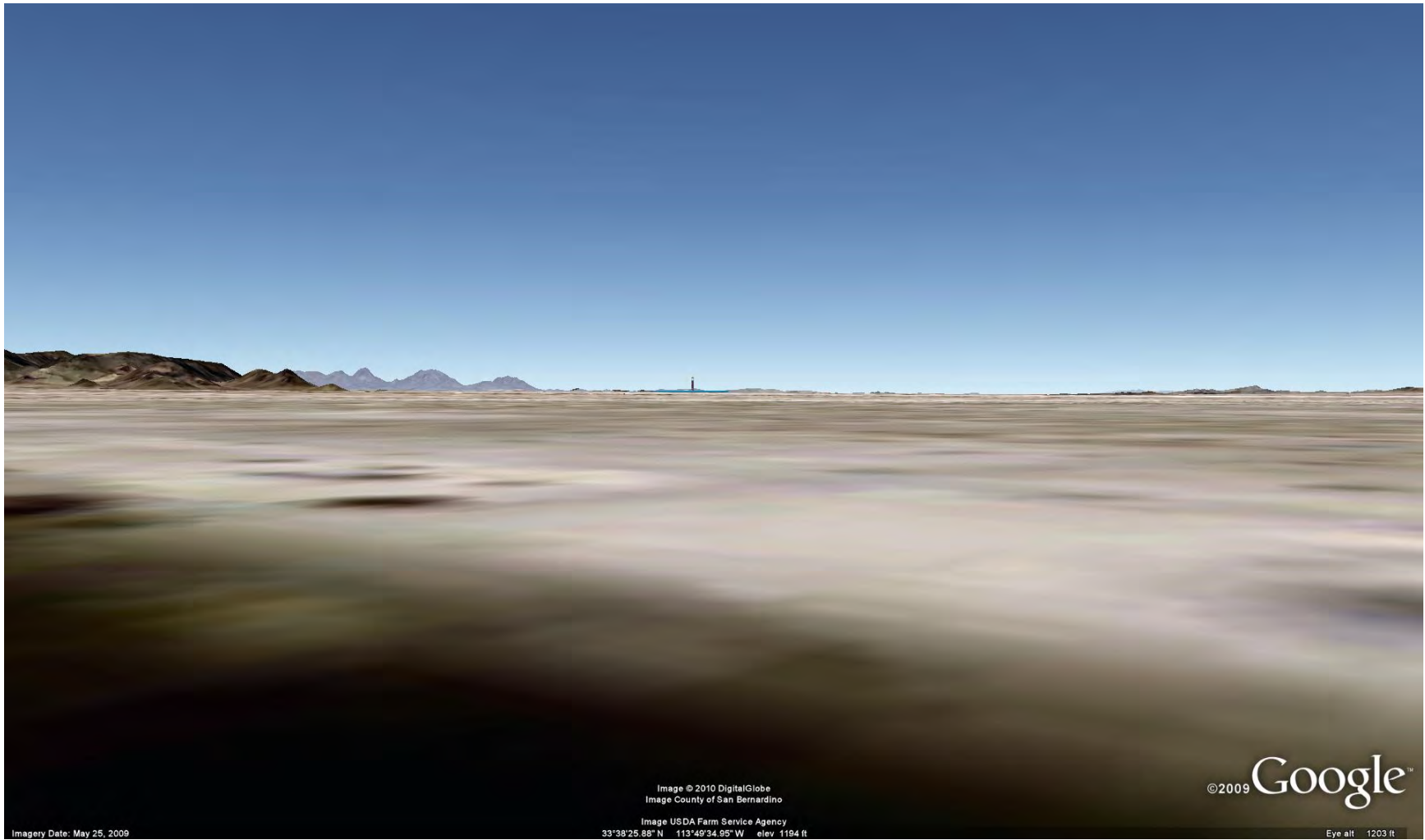
1 of the SEZ; 5 mi (8 km) is the limit of the BLM VRM program’s foreground-middleground
2 distance.

3
4 For westbound travelers on I-10, the SEZ would come into view just west of a pass at
5 the far southern end of the Little Harquahala Mountains, about 15 mi (24 km) from the SEZ.
6 Because of the long distance to the SEZ and low viewing angle, solar facilities within the SEZ
7 would create weak levels of visual contrast after first coming into view. At highway speeds, the
8 SEZ would be in view for about 13 to 14 minutes before views of the SEZ would be cut off by
9 screening from the Bear Hills directly south of the SEZ, at about 4.1 mi (6.7 km) from the SEZ.
10 Facilities located within the SEZ, especially near the road, would attract the eye as travelers
11 approached the SEZ, but would not be expected to dominate views because the forms of the Bear
12 Hills, Plomosa Mountains, New Water Mountains, and Kofa Mountains would strongly attract
13 views and would be directly in front of the vehicle. During the approach, the SEZ and associated
14 solar facilities would gradually increase in apparent size and appear to move farther and farther
15 to the right (north) as travelers approached the SEZ.

16
17 Figure 8.1.14.2-9 is a Google Earth visualization of the SEZ (highlighted in orange) as
18 seen from I-10 approximately 5.4 mi (8.7 km) from the southeast corner of the SEZ. The
19 viewpoint is about 20 ft (7 m) higher in elevation than the SEZ. From this location,
20 collector/reflector arrays of solar facilities within the SEZ would be seen edge-on, and they
21 would repeat the strong line of the horizon, which would tend to reduce visual contrast.
22 However, the SEZ is close enough that it would occupy a moderate amount of the horizontal
23 field of view. Visual contrasts from solar energy development within the SEZ as seen from this
24 viewpoint would depend on solar facility type, size, and location within the SEZ, but would be
25 expected to be moderate. Shortly after reaching this location, the Bear Hills would begin to
26 screen the SEZ from view as travelers passed the SEZ to the south, so visual contrasts for
27 westbound viewers on I-10 would not be expected to reach strong levels.

28
29 Eastbound travelers on I-10 would have a very different visual experience than
30 westbound travelers. For eastbound travelers, the SEZ would first come into view as they
31 approached the U.S. 60 interchange west of Brenda. The SEZ would be partially visible through
32 a narrow gap in the Bear Hills directly northeast of Brenda. Because of the distance between the
33 gap and I-10, the width of the gap is insufficient to permit a view of the entire SEZ from I-10,
34 so travelers would get a brief partial “sweeping” view of solar facilities through the gap as they
35 approached Brenda. The view duration would be about 3 to 4 minutes and would be cut off by
36 screening from the Bear Hills just south of Brenda.

37
38 At the point of closest approach with maximum visibility through the gap (about 4.7 mi
39 [7.5 km]), because there would be only a partial view of the SEZ through the gap, the SEZ would
40 occupy only a small portion of the horizontal field of view, and the angle of view is low, because
41 I-10 is about only about 200 ft (60 m) higher in elevation than the SEZ. In an open setting, this
42 would be expected to create weak levels of visual contrast; however, eastbound travelers’ views
43 tend to focus on the conspicuous gap in the Bear Hills. This would focus visual attention on
44 facilities visible through the gap, particularly if there were glinting or glare from reflective
45 surfaces within the facilities, and especially if there were one or more power tower receivers



1

FIGURE 8.1.14.2-9 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on I-10

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1 visible through the gap, as at this short distance, they could be very bright non-point light
2 sources.

3
4 About 5.5 minutes after passing Brenda, the view of the SEZ for eastbound travelers
5 would open up as they passed the eastern end of the Bear Hills, but by this point, their vehicles
6 would be nearly past the SEZ. Only by turning their heads sharply left would they see solar
7 development within the SEZ before very quickly passing to the east of the SEZ so that it would
8 be behind them. At this point, for viewers looking at the SEZ, moderate levels of visual contrast
9 form solar facilities within the SEZ would be expected.

10
11 In summary, visual contrasts associated with solar energy development within the SEZ
12 would be highly dependent on viewer location on I-10; solar facility type, size, and location
13 within the SEZ; and other visibility factors. Under the 80% development scenario analyzed in
14 this PEIS, weak to moderate visual contrast levels would be expected.

15
16
17 ***Communities of Vicksburg, Brenda, and Hope.*** The viewshed analyses indicate
18 visibility of the SEZ from the community of Vicksburg (approximately 5.8 mi [9.3 km]) east
19 of the SEZ, the community of Brenda (approximately 2.5 mi [4 km] southwest of the SEZ),
20 and the community of Hope (approximately 8.5 mi [14 km] east of the SEZ).

- 21
22 • Vicksburg is only slightly elevated with respect to the SEZ, so the angle of
23 view to the SEZ from Vicksburg is low. Solar facilities within the SEZ would
24 be seen nearly edge-on, and their collector/reflector arrays would appear as
25 thin horizontal lines that would tend to repeat the strong line of the horizon,
26 reducing visual contrast. Taller ancillary facilities, such as buildings,
27 transmission structures, and cooling towers; and plumes (if present) would
28 likely be visible projecting above the collector/reflector arrays. The ancillary
29 facilities could create form and line contrasts with the strongly horizontal,
30 regular, and repeating forms and lines of the collector/reflector arrays. Color
31 and texture contrasts would also be possible, but their extent would depend on
32 the materials and surface treatments utilized in the facilities. If power towers
33 were present in the SEZ, when operating they would likely appear as bright
34 points of light atop discernable tower structures. If more than 200 ft (61 m)
35 tall, power towers could have navigation warning lights at night that would
36 likely be visible from Vicksburg. Weak to moderate levels of visual contrast
37 would be expected.
- 38
39 • Hope is somewhat farther from the SEZ than Vicksburg, but 400 to 500 ft
40 higher in elevation than the SEZ; however, solar facilities within the SEZ
41 would still be seen nearly edge-on, with weak levels of visual contrast
42 expected.
- 43
44 • The far northeastern end of Brenda is 2.3 mi (3.6 km) southwest of the SEZ,
45 and the far southwestern end is about 3.1 mi (5.0 km) southwest of the SEZ.
46 As noted above, the SEZ is visible from Brenda through a gap in the Bear

1 Hills (see Figure 8.1.14.2-8). Because the gap is just east of Brenda, the gap
2 affords relatively open views of the SEZ. Brenda is roughly 100 ft (30 m)
3 higher in elevation than the SEZ, so the angle of view is low; however,
4 because of the short distance to the SEZ and despite partial screening of the
5 SEZ by the Bear Hills and smaller hills between Brenda and the SEZ,
6 moderate to strong visual contrast levels would be expected, depending on
7 viewers' locations within Brenda. The walls of the gap would tend to "frame"
8 views of solar facilities, which would tend to focus views on them,
9 particularly if there were glinting or glare from reflective surfaces within the
10 facilities and especially if there were one or more power tower receivers
11 visible through the gap. If power towers were located within the portion of the
12 SEZ closest to Brenda, they could appear as brilliant nonpoint light sources in
13 the gap, seen against the backdrop of the Granite Wash Mountains northeast
14 of the SEZ. Structures and trees within Brenda might screen some views of
15 the SEZ, but there is little vegetation within Brenda, and the structures are
16 generally low in height and widely spaced, so that screening opportunities
17 would be minimal.

18
19 At night, if power towers more than 200 ft (61 m) tall were located within the
20 SEZ, they could have flashing red or white hazard navigation lights that could
21 be very conspicuous as viewed from Brenda. Other lighting associated with
22 solar facilities within the SEZ could be visible from Brenda as well.

23
24
25 **Other Impacts.** In addition to the impacts described for the resource areas above, nearby
26 residents and visitors to the area may experience visual impacts from solar energy facilities
27 located within the SEZ (as well as any associated access roads and transmission lines) from their
28 residences, or as they travel area roads, particularly U.S. 60 and I-10. The range of impacts
29 experienced would be highly dependent on viewer location; project types, locations, sizes, and
30 layouts; as well as the presence of screening, but under the 80% development scenario analyzed
31 in the PEIS, from some locations, strong visual contrasts from solar development within the SEZ
32 could potentially be observed.

33
34
35 **8.1.14.2.3 Summary of Visual Resource Impacts for the Proposed Brenda SEZ**

36
37 Because under the 80% development scenario analyzed in this PEIS there could be
38 numerous solar facilities within the SEZ, a variety of technologies employed, and a range of
39 supporting facilities that would contribute to visual impacts, a visually complex, man-made
40 appearing industrial landscape could result. This essentially industrial-appearing landscape
41 would contrast greatly with the surrounding generally natural-appearing lands. Large visual
42 impacts on the SEZ and surrounding lands within the SEZ viewshed would be associated with
43 solar energy development within the Brenda SEZ because of major modification of the character
44 of the existing landscape. There is the potential for additional impacts from construction and
45 operation of transmission lines and access roads within and outside the SEZ.

46

1 The SEZ is in an area of low scenic quality. Visitors to the area, workers, and residents of
2 Brenda, Vicksburg, Hope, and nearby areas may experience visual impacts from solar energy
3 facilities located within the SEZ (as well as any associated access roads and transmission lines)
4 as they travel area roads. Residents of Brenda may experience moderate to strong visual
5 contrasts from solar energy development within the SEZ as viewed from the community, and
6 residents nearest to the SEZ along U.S. 60 could be subjected to strong visual contrasts from
7 solar energy development within the SEZ.
8

9 Utility-scale solar energy development within the proposed Brenda SEZ is likely to result
10 in weak to strong visual contrasts for some viewpoints within Plomosa SRMA, which is within
11 0.1 mi (0.2 km) of the SEZ at the point of closest approach. Minimal to weak visual contrasts
12 would be expected for some viewpoints within other sensitive visual resource areas within the
13 SEZ 25-mi (40 km) viewshed.
14

15 U.S. 60 passes very close to the SEZ, and travelers on that road could be subjected to
16 strong visual contrasts from solar development within the SEZ, but typically their exposure
17 would be brief. I-10 is farther from the SEZ but still close enough that travelers on that road
18 could be subjected to moderate to strong visual contrasts from solar development within the
19 SEZ at the closest points, but typically their exposure also would be brief.
20

21 **8.1.14.3 SEZ-Specific Design Features and Design Feature Effectiveness**

22

23
24 No SEZ-specific design features have been identified to protect visual resources for the
25 proposed Brenda SEZ. As noted in Section 5.12, the presence and operation of large-scale solar
26 energy facilities and equipment would introduce major visual changes into non-industrialized
27 landscapes and could create strong visual contrasts in line, form, color, and texture that could not
28 easily be mitigated substantially. Implementation of the programmatic design features that are
29 presented in Appendix A, Section A.2.2, would be expected to reduce the magnitude of visual
30 impacts experienced; however, the degree of effectiveness of these design features could be
31 assessed only at the site- and project-specific level. Because of the large-scale, reflective
32 surfaces, and strong regular geometry of utility-scale solar energy facilities and the typical lack
33 of screening vegetation and landforms within the SEZ viewshed, siting the facilities away from
34 sensitive visual resource areas and other sensitive viewing areas is the primary means of
35 mitigating visual impacts. The effectiveness of other visual impact mitigation measures would
36 generally be limited.
37

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1 **8.1.15 Acoustic Environment**

2
3
4 **8.1.15.1 Affected Environment**

5
6 The proposed Brenda SEZ is located in the south central portion of La Paz County in
7 western Arizona. Neither the State of Arizona nor La Paz County has established quantitative
8 noise-limit regulations applicable to solar energy development.
9

10 U.S. 60 runs east–west as close as about 0.4 mi (0.6 km) to the south, while I-10 runs
11 east–west as close as about 3 mi (5 km) to the south of the proposed Brenda SEZ. State Route 72
12 runs northwest–southeast as close as 4 mi (6 km) to the northeast of the SEZ. A paved county
13 road passes through the western portion of the SEZ. There are good access roads to the site from
14 the south and west of the SEZ but minimal internal roads. The nearest railroad runs about 4 mi
15 (6 km) northeast of the SEZ, parallel to State Route 72. Nearby airports include those in Salome
16 and Quartzsite, about 14 mi (22 km) east and 17 mi (27 km) west of the SEZ, respectively. No
17 industrial activities except grazing are located around the SEZ, and water development (wells)
18 and corrals are developed on the western edge of the SEZ. Large-scale irrigated agricultural
19 lands are situated around the SEZ, about 5 mi (8 km) to the southeast and 6 mi (10 km) to the
20 north–northeast. No sensitive receptors (e.g., hospitals, schools, or nursing homes) exist very
21 close to the proposed Brenda SEZ. The nearest residences from the SEZ boundary are about
22 0.3 mi (0.5 km) to the southeast. Several RV/trailer parks have developed along U.S. 60, from
23 Pioneer, 0.4 mi (0.6 km) to the south of the SEZ to Brenda, 2 mi (3.2 km) to the southwest of the
24 SEZ. The nearby population centers with schools include Salome, about 14 mi (22 km) east–
25 northeast of the SEZ; Bouse, about 15 mi (24 km) north–northwest; and Quartzsite, about 16 mi
26 (26 km) west. Accordingly, noise sources around the SEZ include road traffic, railroad traffic,
27 infrequent aircraft flyover, animal grazing, and occasional community activities and events.
28 Other noise sources are associated with current land use around the SEZ, including probable
29 outdoor recreation and OHV use. The proposed Brenda SEZ is mostly undeveloped, the overall
30 character of which is considered rural. To date, no environmental noise survey has been
31 conducted around the proposed Brenda SEZ. On the basis of the population density, the day-
32 night average noise level (L_{dn} or DNL) is estimated to be 28 dBA L_{dn} for La Paz County, below
33 the range of 33 to 47 dBA L_{dn} typical of a rural area (Eldred 1982; Miller 2002).¹⁰
34
35

36 **8.1.15.2 Impacts**

37
38 Potential noise impacts associated with solar projects in the Brenda SEZ would occur
39 during all phases of the projects. During the construction phase, potential noise impacts
40 associated with operation of heavy equipment and vehicular traffic on the nearest residences
41 (about 0.3 mi [0.5 km] to the southeast of the SEZ boundary) would be anticipated, albeit of
42 short duration. During the operations phase, potential impacts on nearby residences would be

¹⁰ Rural and undeveloped areas have sound levels in the range of 33 to 47 dBA as L_{dn} (Eldred 1982). Typically, nighttime levels are 10 dBA lower than daytime levels, and they can be interpreted as 33 to 47 dBA (mean 40 dBA) during daytime hours and 23 to 37 dBA (mean 30 dBA) during nighttime hours.

1 anticipated, depending on the solar technologies employed. Noise impacts shared by all solar
2 technologies are discussed in detail in Section 5.13.1, and technology-specific impacts are
3 presented in Section 5.13.2. Impacts specific to the proposed Brenda SEZ are presented in this
4 section. Any such impacts would be minimized through the implementation of required
5 programmatic design features described in Appendix A, Section A.2.2, and through any
6 additional SEZ-specific design features applied (see Section 8.1.15.3 below). This section
7 primarily addresses potential noise impacts on humans, although potential impacts on wildlife at
8 nearby sensitive areas are discussed. Additional discussion on potential noise impacts on wildlife
9 is presented in Section 5.10.2.

12 **8.1.15.2.1 Construction**

14 The proposed Brenda SEZ has a relatively flat terrain; thus, minimal site preparation
15 activities would be required, and associated noise levels would be lower than those during
16 general construction (e.g., erecting building structures and installing equipment, piping, and
17 electrical).

18
19 For the parabolic trough and power tower technologies, the highest construction noise
20 levels would occur at the power block area, where key components (e.g., steam turbine/
21 generator) needed to generate electricity are located; a maximum of 95 dBA at a distance of
22 50 ft (15 m) is assumed, if impact equipment such as pile drivers or rock drills is not being used.
23 Typically, the power block area is located in the center of the solar facility, at a distance of more
24 than 0.5 mi (0.8 km) from the facility boundary. Noise levels from construction of the solar array
25 would be lower than 95 dBA. When geometric spreading and ground effects are considered, as
26 explained in Section 4.13.1, noise levels would attenuate to about 40 dBA at a distance of
27 1.2 mi (1.9 km) from the power block area. This noise level is typical of daytime mean rural
28 background levels. In addition, mid- and high-frequency noise from construction activities is
29 significantly attenuated by atmospheric absorption under the low-humidity conditions typical of
30 an arid desert environment and by temperature lapse conditions typical of daytime hours; thus
31 noise attenuation to a 40-dBA level would occur at distances somewhat shorter than 1.2 mi
32 (1.9 km). If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA
33 L_{dn} for residential areas (EPA 1974) would occur about 1,200 ft (370 m) from the power block
34 area, which would be well within the facility boundary. For construction activities occurring
35 near the residences closest to the southeastern SEZ boundary, estimated noise levels at the
36 nearest residences would be about 55 dBA, which is well above the typical daytime mean rural
37 background level of 40 dBA. However, this noise might be masked by road traffic on U.S. 60
38 to some extent. In addition, an estimated 51-dBA L_{dn} ¹¹ at these residences is below the EPA
39 guidance of 55 dBA L_{dn} for residential areas.

41 In addition, noise levels were estimated at specially designated areas within 5 mi (8 km)
42 of the proposed Brenda SEZ, which is the farthest distance that noise (except extremely loud
43 noise) would be discernable. There is only one specially designated area within this area:

¹¹ For this analysis, background levels of 40 and 30 dBA for daytime and nighttime hours, respectively, were assumed, which resulted in a day-night average noise level (L_{dn}) of 40 dBA.

1 Plomosa SRMA, which is located as close as 700 ft (210 m) west of the SEZ. Noise levels of
2 60 dBA and 50 dBA are estimated at about 0.2 mi (0.3 km) and 0.5 mi (0.8 km) from the
3 construction site, respectively. Thus, if construction would occur near the western SEZ
4 boundary, areas within Plomosa SRMA (within 0.5 mi [0.8 km] from the SRMA boundary)
5 could be disturbed by construction noise from the SEZ. As discussed in Section 5.10.2, sound
6 levels above 90 dB are likely to adversely affect wildlife (Manci et al. 1988). Thus, construction
7 noise is not likely to adversely affect wildlife except in areas directly adjacent to the construction
8 site.

9
10 Depending on soil conditions, pile driving might be required for installation of solar dish
11 engines. However, the pile drivers used, such as vibratory or sonic drivers, would be relatively
12 small and quiet, in contrast to the impulsive impact pile drivers frequently used at large-scale
13 construction sites. Potential impacts on the nearest residences would be anticipated to be
14 negligible, considering the distance (about 0.3 mi [0.5 km] from the SEZ boundary).

15
16 It is assumed that most construction activities would occur during the day, when noise is
17 better tolerated, because of the masking effects of background noise than at night. In addition,
18 construction activities for a utility-scale facility are temporary in nature (typically a few years).
19 Construction within the proposed Brenda SEZ would cause some unavoidable but localized
20 short-term noise impacts on neighboring communities, particularly for activities occurring near
21 the southern proposed SEZ boundary, close to the nearby residences along U.S. 60.

22
23 Construction activities could result in various degrees of ground vibration, depending
24 on the equipment used and construction methods employed. All construction equipment causes
25 ground vibration to some degree, but activities that typically generate the most severe vibrations
26 are high-explosive detonations and impact pile driving. As is the case for noise, vibration would
27 diminish in strength with distance. For example, vibration levels at receptors beyond 140 ft
28 (43 m) from a large bulldozer (87 VdB at 25 ft [7.6 m]) would diminish below the threshold of
29 perception for humans, which is about 65 VdB (Hanson et al. 2006). During the construction
30 phase, no major construction equipment that can cause ground vibration would be used, and no
31 residences or sensitive structures are located in close proximity. Therefore, no adverse vibration
32 impacts are anticipated from construction activities, including pile driving for dish engines.

33
34 It is assumed that a transmission line would be constructed to connect to the nearest
35 regional power grid. A 161-kV transmission line is located about 19 mi (31 km) from the
36 proposed Brenda SEZ; thus, construction of a transmission line over this relatively long distance
37 would be needed to connect to the regional grid. For construction of transmission lines, noise
38 sources and their noise levels might be similar to construction noise sources at an industrial
39 facility of a comparable size. Transmission line construction for the Brenda SEZ could be
40 performed in about two years. However, the area under construction along the transmission line
41 ROW would move continuously, so no particular area would be exposed to noise for a prolonged
42 period. Therefore, potential noise impacts on nearby residences along the transmission line
43 ROW, if any, would be minor and temporary in nature.

1 **8.1.15.2.2 Operations**
2

3 Noise sources common to all or most types of solar technologies include equipment
4 motion from solar tracking, maintenance, and repair activities (e.g., washing mirrors or replacing
5 broken mirrors) at the solar array area; commuter/visitor/support/delivery traffic within and
6 around the solar facility; and control/administrative buildings, warehouses, and other auxiliary
7 buildings/structures. Diesel-fired emergency power generators and firewater pump engines
8 would be additional sources of noise, but their operations would be limited to several hours per
9 month (for preventive maintenance testing).
10

11 With respect to the main solar energy technologies, noise-generating activities in the
12 PV solar array area would be minimal, related mainly to solar tracking, if used. On the other
13 hand, dish engine technology, which employs collector and converter devices in a single unit,
14 generally has the strongest noise sources.
15

16 For the parabolic trough and power tower technologies, most noise sources during
17 operations would be in the power block area, including the turbine generator (typically in an
18 enclosure), pumps, boilers, and dry- or wet-cooling systems. The power block is typically
19 located in the center of the facility. On the basis of a 250-MW parabolic trough facility with a
20 cooling tower (Beacon Solar, LLC 2008), simple noise modeling indicates that noise levels
21 around the power block would be more than 85 dBA, but about 51 dBA at the facility boundary,
22 about 0.5 mi (0.8 km) from the power block area. For a facility located near the southeastern
23 SEZ boundary, the predicted noise level would be about 47 dBA at the nearest residences, about
24 0.3 mi (0.5 km) from the SEZ boundary, which is higher than the typical daytime mean rural
25 background level of 40 dBA. However, this noise might be masked by road traffic on U.S. 60
26 to some extent. If TES were not used (i.e., if the operation were limited to daytime, 12 hours
27 only¹²), the EPA guideline level of 55 dBA (as L_{dn} for residential areas) would occur at about
28 1,370 ft (420 m) from the power block area and thus would not be exceeded outside of the
29 proposed SEZ boundary. At the nearest residences, about 45 dBA L_{dn} would be estimated,
30 which is well below the EPA guideline of 55 dBA L_{dn} for residential areas. However, day-
31 night average noise levels higher than those estimated above by using simple noise modeling
32 would be anticipated if TES were used during nighttime hours, as explained below and in
33 Section 4.13.1.
34

35 On a calm, clear night typical of the proposed Brenda SEZ setting, the air temperature
36 would likely increase with height (temperature inversion) because of strong radiative cooling.
37 Such a temperature profile tends to focus noise downward toward the ground. There would be
38 little, if any, shadow zone¹³ within 1 or 2 mi (1.6 or 3 km) of the noise source in the presence
39 of a strong temperature inversion (Beranek 1988). In particular, such conditions add to the
40 effect of noise being more discernable during nighttime hours, when the background noise
41 levels are lowest. To estimate the day-night average sound level (L_{dn}), 6-hour nighttime
42 generation with TES is assumed after 12-hour daytime generation. For nighttime hours under

12 Maximum possible operating hours at the summer solstice, but limited to 7 to 8 hours at the winter solstice.

13 A shadow zone is defined as the region in which direct sound does not penetrate because of upward diffraction.

1 temperature inversion, 10 dB is added to sound levels estimated from the uniform atmosphere
2 (see Section 4.13.1). On the basis of these assumptions, the estimated nighttime noise level at the
3 nearest residences (about 0.3 mi [0.5 km] from the SEZ boundary) would be about 57 dBA,
4 which is well above the typical nighttime mean rural background level of 30 dBA. The day-night
5 average noise level is estimated to be about 58 dBA L_{dn} , which is above the EPA guideline of
6 55 dBA L_{dn} for residential areas. The assumptions are conservative in terms of operating hours,
7 and no credit was given to other attenuation mechanisms, so it is likely that sound levels would
8 be lower than 58 dBA L_{dn} at the nearest residences, even if TES were used at a solar facility.
9 Consequently, operating parabolic trough or power tower facilities using TES and located near
10 the SEZ boundary could result in adverse noise impacts at the nearest residences, depending on
11 background noise levels and meteorological conditions.

12
13 Associated with operation of a solar facility using TES, estimated noise levels would be
14 about 51 dBA at the SEZ boundary and 41 dBA at about 1 mi (1.6 km) outside from the SEZ
15 boundary. Thus, for a solar facility located near the western SEZ boundary, areas within Plomosa
16 SRMA (within 1 mi [1.6 km] from the SRMA boundary) could be disturbed by the operational
17 noise from the SEZ but this is not anticipated to adversely affect wildlife (Manci et al. 1988).

18
19 In the permitting process, refined noise propagation modeling would be warranted along
20 with measurement of background noise levels.

21
22 The solar dish engine is unique among CSP technologies, because it generates electricity
23 directly and does not require a power block. A single, large solar dish engine has relatively low
24 noise levels, but a solar facility might employ tens of thousands of dish engines, which would
25 cause high noise levels around such a facility. For example, the proposed 750-MW SES Solar
26 Two dish engine facility in California would employ as many as 30,000 dish engines (SES
27 Solar Two, LLC 2008). At the proposed Brenda SEZ, on the basis of the assumption of dish
28 engine facilities of up to 345-MW total capacity (covering 80% of the total area, or 3,102 acres
29 [12.55 km²]), up to 13,788 25-kW dish engines could be employed. For a large dish engine
30 facility, several hundred step-up transformers would be embedded in the dish engine solar field,
31 along with a substation; however, the noise from these sources would be masked by dish engine
32 noise.

33
34 The composite noise level of a single dish engine would be about 88 dBA at a distance of
35 3 ft (0.9 m) (SES Solar Two, LLC 2008). This noise level would be attenuated to about 40 dBA
36 (typical of the mean rural daytime environment) within 330 ft (100 m). However, the combined
37 noise level from tens of thousands of dish engines operating simultaneously would be high in the
38 immediate vicinity of the facility, for example, about 48 dBA at 1.0 mi (1.6 km) and 43 dBA at
39 2 mi (3.2 km) from the boundary of the square-shaped dish engine solar field; both values are
40 higher than the typical daytime mean rural background level of 40 dBA. However, these levels
41 would occur at somewhat shorter distances than the aforementioned distances, considering noise
42 attenuation by atmospheric absorption and temperature lapse during daytime hours. To estimate
43 noise levels at the nearest residences, it was assumed dish engines were placed all over the
44 Brenda SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise level at
45 the nearest residences, about 0.3 mi (0.5 km) from the SEZ boundary, would be about 51 dBA,
46 which is above the typical daytime mean rural background level of 40 dBA. On the basis of

1 12-hr daytime operation, the estimated 49 dBA L_{dn} at these residences is below the EPA
2 guideline of 55 dBA L_{dn} for residential areas. On the basis of other noise attenuation
3 mechanisms, noise levels at the nearest residences would be lower than the values estimated
4 above. However, noise from dish engines could cause adverse impacts on the nearest residences,
5 depending on background noise levels and meteorological conditions.

6
7 For dish engines placed all over the SEZ, estimated noise levels would be about 51 dBA
8 at the boundary of Plomosa SRMA, which is about 700 ft (210 m) from the SEZ boundary.
9 Areas within the Plomosa SRMA (within 0.5 mi [0.8 km] of the SRMA boundary) could be
10 disturbed by the dish engine noise from the SEZ, but this is not anticipated to adversely affect
11 wildlife (Manci et al. 1988).

12
13 Consideration of minimizing noise impacts is very important during the siting of dish
14 engine facilities. Direct mitigation of dish engine noise through noise control engineering could
15 also limit noise impacts.

16
17 During operations, no major ground-vibrating equipment would be used. In addition,
18 no sensitive structures are located close enough to the proposed Brenda SEZ to experience
19 physical damage. Therefore, during operation of any solar facility, potential vibration impacts
20 on surrounding communities and vibration-sensitive structures would be negligible.

21
22 Transformer-generated humming noise and switchyard impulsive noises would be
23 generated during the operation of solar facilities. These noise sources would be located near the
24 power block area, typically near the center of a solar facility. Noise from these sources would
25 generally be limited within the facility boundary and not be heard at the nearest residences,
26 assuming a 0.8-mi (1.3-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and 0.3 mi
27 [0.5 km] to the nearest residences). Accordingly, potential impacts of these noise sources on the
28 nearest residences would be negligible.

29
30 For impacts from transmission line corona discharge noise during rainfall events
31 (discussed in Section 5.13.1.5), the noise level at 50 ft (15 m) and 300 ft (91 m) from the
32 center of 230-kV transmission line towers would be about 39 and 31 dBA respectively
33 (Lee et al. 1996), typical of daytime and nighttime mean background noise levels in rural
34 environments. Corona noise includes high-frequency components, considered to be more
35 annoying than low-frequency environmental noise. However, corona noise would not likely
36 cause impacts unless a residence was close to it (e.g., within 500 ft [152 m] of a 230-kV
37 transmission line). The proposed Brenda SEZ is located in an arid desert environment, and
38 incidents of corona discharge are infrequent. Therefore, potential impacts on nearby residences
39 from corona noise along transmission lines within the SEZ would be negligible.

40 41 42 ***8.1.15.2.3 Decommissioning/Reclamation***

43
44 Decommissioning/reclamation requires many of the same procedures and equipment
45 used in traditional construction. Decommissioning/reclamation would include dismantling of
46 solar facilities and support facilities such as buildings/structures and mechanical/electrical

1 installations, disposal of debris, grading, and revegetation as needed. Activities for
2 decommissioning would be similar to those for construction but more limited. Potential
3 noise impacts on surrounding communities would be correspondingly lower than those for
4 construction activities. Decommissioning activities would be of short duration, and their
5 potential impacts would be moderate and temporary in nature. The same mitigation measures
6 adopted during the construction phase could also be implemented during the decommissioning
7 phase.
8

9 Similarly, potential vibration impacts on surrounding communities and vibration-
10 sensitive structures during decommissioning of any solar facility would be lower than those
11 during construction and thus negligible.
12
13

14 **8.1.15.3 SEZ-Specific Design Features and Design Feature Effectiveness** 15

16 The implementation of required programmatic design features described in Appendix A,
17 Section A.2.2, would greatly reduce or eliminate the potential for noise impacts from
18 development and operation of solar energy facilities. While some SEZ-specific design features
19 are best established when specific project details are being considered, measures that can be
20 identified at this time include the following:
21

- 22 • Noise levels from cooling systems equipped with TES should be managed so
23 that levels at the residences near the southern SEZ boundary along U.S. 60 are
24 kept within applicable guidelines. This could be accomplished in several
25 ways, for example, through placing the power block approximately 1 to 2 mi
26 (1.6 to 3 km) or more from residences, limiting operations to a few hours after
27 sunset, and/or installing fan silencers.
28
- 29 • Dish engine facilities within the Brenda SEZ should be located more than 1 to
30 2 mi (1.6 to 3 km) from the nearest residences (i.e., the facilities should be
31 located in the northern portion of the proposed SEZ). Direct noise control
32 measures applied to individual dish engine systems could also be used to
33 reduce noise impacts at nearby residences.
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8.1.16 Paleontological Resources

8.1.16.1 Affected Environment

The surface geology of the proposed Brenda SEZ is composed entirely of thick alluvial deposits (more than 100 ft [30 m] thick), ranging in age from the Pliocene to Holocene. The total acreage of the alluvial deposits within the SEZ is 3,878 acres (15.7 km²). In the absence of a PFYC map for Arizona, a preliminary classification of potential fossil yield classification (PFYC) Class 3b is assumed for the young Quaternary alluvial deposits (see Section 4.8 for a discussion of the PFYC system). Class 3b indicates that the potential for the occurrence of significant fossil materials is unknown and needs to be investigated further. Late Pleistocene (Rancholabrean) vertebrate fauna of *Mammuthus columbi*, *Equui large* sp., *Equui small* sp., and *Nothrotherium* have been identified in a lens of lag gravel within fine-grained alluvial sediments in Maricopa County, Arizona, at a depth of less than 20 ft (6 m) from the natural topographic surface (Lunden and Royse 1973). In addition to Pleistocene fauna, there also is a potential for Miocene faunas from these basin fill deposits. Rhinoceros and camel have been documented at Anderson Mine in southwestern Yavapai County (Morgan and White 2005). These finds indicate the potential for other similar finds in the region.

8.1.16.2 Impacts

The potential for impacts on significant paleontological resources in the proposed SEZ is unknown. A more detailed investigation of the alluvial deposits is needed prior to project approval. A paleontological survey will likely be needed following consultation with the BLM. The appropriate course of action would be determined as established in BLM IM2008-9 and IM2009-011 (BLM 2007b, 2008a). Section 5.14 discusses the types of impacts that could occur on any significant paleontological resources found to be present within the proposed Brenda SEZ. Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2.

Indirect impacts on paleontological resources outside of the SEZ, such as through looting or vandalism, are unknown but unlikely because any such resources would be below the surface and not readily accessed. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the SEZ.

Approximately 19 mi (31 km) of transmission line is anticipated to be needed to connect to an existing line west of the SEZ, resulting in approximately 575 acres (2.3 km²) of disturbance in areas predominantly composed of alluvial sediments (preliminarily classified as PFYC Class 3b). Direct impacts during construction are possible in PFYC Class 3b areas, but since the assumed route of the line follows existing road corridors (U.S. 60 and I-10), the potential for impacts is reduced because of the prior ground disturbance. No needs for new access roads have currently been identified, assuming an existing road would be used; therefore, no additional areas of paleontological concern would be made accessible as a result of development within the proposed Brenda SEZ. However, impacts on paleontological resources related to the creation of

1 new corridors not assessed in this PEIS would be evaluated at the project-specific level if new
2 road or transmission construction or line upgrades were to occur.

3
4 Programmatic design features requiring a stop work order in the event of an inadvertent
5 discovery of paleontological resources would reduce impacts by preserving some information
6 and allowing possible excavation of the resource, if warranted. Depending on the significance of
7 the find, it could also result in some modification to the project footprint. Since the SEZ is
8 located in an area classified as PFYC Class 3b, a stipulation would be included in permitting
9 documents to alert solar energy developers of the possibility of a delay if paleontological
10 resources are uncovered during surface-disturbing activities.

11 12 13 **8.1.16.3 SEZ-Specific Design Features and Design Feature Effectiveness**

14
15 Impacts would be minimized through the implementation of required programmatic
16 design features, including a stop-work stipulation in the event that paleontological resources are
17 encountered during construction, as described in Appendix A, Section A.2.2.

18
19 The need for and the nature of any SEZ-specific design features would depend on the
20 findings of future paleontological surveys.

1 **8.1.17 Cultural Resources**

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4 **8.1.17.1 Affected Environment**

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7 **8.1.17.1.1 Prehistory**

8
9 The proposed Brenda SEZ is located in the northern Sonoran Desert within the basin and
10 range province in western Arizona. The earliest known use of the area was likely during the
11 Paleoindian Period, sometime between 12,000 and 10,000 B.P. Surface finds of Paleoindian
12 fluted projectile points, the hallmark of the Clovis culture, have not been found in the area; most
13 of the sites from this time period are located in the southeastern part of the state. The closest
14 known Paleoindian finds to the proposed Brenda SEZ are at Painted Rocks Reservoir, 68 mi
15 (110 km) to the southeast, and Ventana Cave, about 150 mi (241 km) to the southeast. In
16 addition to these projectile points, Clovis people are characterized by a hunting and gathering
17 subsistence economy in which they followed migrating herds of Pleistocene mega fauna.
18 Paleoindian sites in Arizona are typically characterized by either fluted or unfluted points, extinct
19 mega fauna, chipped stone tools, and bone and horn implements. Tools were fashioned either
20 from chert or from obsidian; the closest known source of obsidian to the proposed Brenda SEZ is
21 located at Vulture Mountain, 50 mi (80 km) to the east. The majority of Paleoindian sites occur
22 in the transition zone between mountain and desert environments, and those that have been found
23 in the desert are located close enough to the transition zone that it can be assumed they were
24 likely located there during Paleoindian times. Paleoindian sites that are found generally are either
25 kill sites, where large numbers of animals were slaughtered, or other sites, thought to be base
26 camps (Martin and Plog 1973; NROSL 2009; Reid and Whittlesey 1997).

27
28 The Archaic Period began at the end of the Pleistocene, about 10,000 to 8,000 B.P., and
29 continued until the advent of ceramics, about 2,000 B.P. Also referred to as the Cochise Culture,
30 the Archaic lifeways were similar to those of their Paleoindian predecessors, hunting and
31 gathering wild animals and plants. However, plants took on a greater role as there were no longer
32 the mega fauna to hunt, and smaller animals such as deer, antelope and rabbits were hunted
33 instead. Consequently, plant processing tools, such as manos and metates, are more prevalent in
34 the archaeological record. Archaic peoples likely followed a seasonal round of movement,
35 harvesting and hunting what was available at that place and time; therefore, these ephemeral sites
36 are difficult to distinguish. Ventana Cave contained not only Paleoindian material but also
37 significant amounts of Archaic artifacts. Caves provide especially good preservation, and
38 normally perishable artifacts are sometimes well preserved in cave environments. Artifacts such
39 as cordage, netting, hides, skins, and sandals have been found, providing valuable information
40 about Archaic lifeways in the desert Southwest. Because Archaic people were so mobile, they
41 maintained light and portable equipment—baskets, milling stones, and spear points being the
42 hallmarks of the Archaic culture. It is assumed that Archaic Period groups would have lived and
43 traveled with groups of related families when local resources were abundant, but during hard
44 times groups likely dispersed, separated from other families by environmental features such as
45 deserts or mountain ranges. Groups may have isolated themselves in resource-rich regions for a
46 sustained period of time, resulting in vast tracts of land that would have been unpopulated for

1 long spans of time. Other artifacts associated with southern Arizonan Archaic Period lifeways
2 are sleeping circles or camp clearings, trails, shrines, rock alignments, and zoomorphic intaglios,
3 sites of which have been identified within 5 mi (8 km) of the proposed Brenda SEZ (Reid and
4 Whittlesey 1997).

5
6 The Late Archaic Period saw the beginnings of agriculture in Arizona. The Sonoran
7 Desert is believed to have been the heartland from which corn agriculture spread to the rest of
8 Arizona. In the middle of the twentieth century it was proposed that corn agriculture spread to
9 Arizona from Mexico via the Sierra Madre corridor to the Mogollon highlands, into the Colorado
10 Plateau, and then into the Sonoran Desert prior to being adopted by the rest of the region. More
11 recent research has suggested the opposite, that the Sonoran Desert's warm growing conditions
12 and the planting of corn at low elevations using well-watered floodplains was more conducive to
13 corn agriculture, and the technology spread widely from the Sonoran Desert into the rest of
14 Arizona. While these Late Archaic farmers were growing corn, it was not their only means of
15 subsistence, and therefore they continued to maintain a seasonal round of hunting and gathering,
16 while retaining a residence for a period of time near their fields to plant and harvest their crops.
17 Their base camps were located in the lowlands, usually occupied in the summer; these clusters of
18 houses usually formed a generally circular arrangement with pits located in the floors of houses
19 or in the areas between houses for the storage of tools and food. Often the floors of houses were
20 completely taken up by the storage pits and there were no hearths, leading some archaeologists to
21 believe that the primary function of the houses was for storage. Some Late Archaic sites have
22 been found to have large, domed-shaped structures, believed to be ceremonial in nature. The
23 artifacts that have been found in them tend to be religious in nature; a baton made of phyllite,
24 pigments, figurines, bone tubes, and worked shell pieces. It is believed that these structures were
25 the predecessor to the subsurface kivas constructed by later Southwestern groups. Late Archaic
26 groups also were known to have created ceramics, although they were fashioned not into
27 containers but into figurines and beads (Reid and Whittlesey 1997; Matson 1991).

28
29 With the end of the Archaic Period, two distinct groups occupied the area in the vicinity
30 of the proposed Brenda SEZ: the Hohokam people, who were largely centered near the Gila
31 River and its tributaries, and the Patayan culture, which was focused on the Colorado River and
32 its tributaries. The proposed Brenda SEZ is between these two rivers, so both cultural groups are
33 discussed.

34
35 There are two branches of the Hohokam culture, the River Hohokam and the Desert
36 Hohokam, the tradition beginning around A.D. 300 and extending until A.D. 1450. The River
37 Hohokam lived in large villages, sometimes occupied for hundreds of years, and utilized the
38 river to irrigate their crops through the construction of canals. This ability to establish long-term
39 occupations because of the river as a reliable water source, allowed extensive public architectural
40 projects to be undertaken and craft specialization to occur. At some River Hohokam sites
41 platform mounds and ball courts have been excavated. It has been suggested that the construction
42 of large-scale irrigation projects, platform mounds, and ball courts reflects a complex social and
43 political relationship among the Hohokam. The Desert Hohokam relied on floodwater and
44 rainwater for farming. They lived in the valleys and bajadas that were not near the river zones
45 and planted their fields on alluvial fans and at the mouths of washes. Because the Desert
46 Hohokam relied on more ephemeral sources of water, they did not develop the long-term

1 occupation of sites and social complexity that the River Hohokam did. Both the River and Desert
2 Hohokam groups supplemented their diets through the collection of wild plants and hunting,
3 helping to provide some subsistence reliability during difficult agricultural times. During the
4 course of the Hohokam culture, settlements became more and more densely populated, and
5 shifts in material culture and changes in ceremonial and agricultural practices occurred. The
6 archaeological assemblage associated with the Hohokam cultural tradition consists of ceramics
7 (vessels and figurines); bedrock mortars; carved, ground, and flaked stone artifacts; shell
8 jewelry; and stone bowls with effigies. Evidence of Hohokam occupation in the archaeological
9 record becomes very sparse during the late fourteenth and fifteenth centuries, suggesting that
10 either the culture changed its lifeways significantly enough to affect interpretation of cultural
11 materials related to the Hohokam or the Hohokam left the area, possibly due to excessive
12 flooding, oversalinization of agricultural fields, or conflicts with competing groups (BLM 2010b;
13 McGuire and Schiffer 1982; Reid and Whittlesey 1997).

14
15 The Patayan culture also occupied different regions of the Colorado River Valley; some
16 groups were concentrated in the upland environments, others in the lowlands. Similar to the
17 Desert Hohokam, the Patayan culture also used floodwater to irrigate their crops, with the first
18 evidence of the Patayan culture seen around A.D. 700. Most Patayan sites are ephemeral,
19 generally indicating temporary habitation or activity camps, although there are a few large
20 Patayan sites on the southwest portion of the Gila River representing more permanent village
21 settlements. It is believed that the Patayan and Hohokam maintained a friendly relationship
22 and the interaction between the groups increased through time. The Patayan moved seasonally,
23 occupying the river valleys in the summer while maintaining their horticultural endeavors
24 and moving to the uplands to exploit piñon nuts and other upland resources. Trade was likely
25 important for the Patayan people, and they created a vast network of trails, not only for trade
26 but also for travel and connecting ceremonial territories. Along the trails, cairns and shrines
27 can be found, as well as campsites, intaglios, cleared circles, and petroglyphs. It is believed
28 that the Patayan culture was the antecedent culture to the contemporary Native American
29 groups that were in the area (the Maricopa, Mohave, Quechan, and Yavapai), but some suggest
30 Hohokam derivation instead. Pima groups are thought to have been descended from the
31 Hohokam culture (BLM 2010b; McGuire and Schiffer 1982; Neusius and Gross 2007;
32 Reid and Whittlesey 1997).

33 34 35 **8.1.17.1.2 Ethnohistory**

36
37 The proposed Brenda SEZ is situated in the western part of traditional Yavapai territory,
38 the portion inhabited by the Tolkapaya or Western Yavapai. Tolkapaya territory ranged from the
39 mountains east of the Colorado, eastward to the western slopes of Kirkland Valley. Many
40 Tolkapayas traveled periodically to the banks of the Colorado River and planted crops near the
41 Quechan, with whom they were on friendly terms. The Quechan in turn would from time to time
42 travel to the mountainous regions of Tolkapaya territory to access upland resources not available
43 in their own lands (Khera and Mariella 1983). Their allies, the Mohave, hunted in Yavapai lands
44 (BLM 2008b). Members of both groups may have been familiar with the area of the proposed
45 SEZ. The Western Yavapai may also have interacted with the neighboring Halchidoma.
46

1 **Yavapai**
2

3 Traditionally the Yavapai were inhabitants of west central Arizona who spoke a common
4 language and thought of themselves as one people originating in the Sedona Red Rock country.
5 They were and are speakers of an Upland Yuman dialect of the Hokan language family. Their
6 northern boundary ranged from the San Francisco Peaks to north of the Santa Maria and Bill
7 Williams Rivers. Westward they extended to the mountains and lowlands along the Colorado
8 River. On the south they extended as far as the mountains north of the Gila River, the northern
9 bank of the Salt River, through the lower Verde Valley to the Superstition and Pinal Mountains.
10 Their eastern extent included the Tonto Basin and the Mogollon Rim. Traditionally they were
11 divided into four subtribes. The range of the Tolkapaya, the southwestern portion of Yavapai
12 territory, was the most extensive of the four (Khera and Mariella 1983).
13

14 The Yavapai developed from the Northeastern Pai, who appear to have emerged from the
15 prehistoric Patayan tradition. The Yavapai may have diverged from the Hualapai and Havasupai
16 as late as the eighteenth Century (Bean et al. 1978). Like many of their neighbors, the Yavapai
17 depended on a mixture of agriculture and a seasonal round of hunting and gathering for their
18 subsistence. Gardens including maize, beans, and squash were planted both on floodplains and
19 in irrigated plots. Settlement size and duration were dictated by the abundance and availability
20 of nearby resources. In the western desert, the presence of water—rivers, streams, springs, or
21 natural tanks—was essential. Yavapai traditional territory included the Sonoran Desert,
22 mountain, and transitional environments, providing a wide range of seasonal resources. Yavapai
23 groups were highly mobile and flexible in size. Deer, pronghorn antelope, and bighorn sheep
24 were among the large game animals they hunted, along with a wide range of smaller species.
25 Mescal, available year-round, was a dietary staple of the Yavapai (Gifford 1932). However, their
26 greatest food supply was in the fall when nuts (acorns, piñon, and walnuts), seeds (sunflower,
27 goldeneye, and wild grasses), and berries (manzanita, juniper, cedar, mulberry, hackberry, and
28 lemon berries) were ripening (Khera and Mariella 1983).
29

30 As with other highly mobile groups in the West, the Yavapai were skilled creators of
31 light strong basketry, used for a variety of purposes. Pottery was also known. They used stone
32 manos and metates to process the seed and nuts. Other tools and hunting implements were made
33 of wood, chipped stone, and cane, as appropriate. Winter dwellings were in caves, rock shelters,
34 or pole-dome huts roofed with thatch and covered with dirt. Summer residences were open
35 ramada structures (Gifford 1932; Khera and Mariella 1983).
36

37 The Yavapai were often at odds with their northern and southern neighbors, the Walapai,
38 Havasupai, Papago, Pima, and Maricopa, but got along well with their western and eastern
39 neighbors, the Mojave, Quechan, Cocopah, and Apache. Until the discovery of gold in central
40 Arizona during the 1860s, the Yavapai had little contact with Euro-Americans. When Euro-
41 Americans began to arrive, they and their livestock began to diminish the water, plant, game,
42 and farmland resources upon which the Yavapai depended. Although the Yavapai were for the
43 most part peaceful, lacking firearms early on, Euro-Americans tended to view them as Apache
44 and dealt with them violently and the Yavapai responded in kind (Bean et al. 1978). In 1865,
45 about 2,000 Tolkapayas agreed to settle with other Tribes on the Colorado River Reservation.
46 However, the reservation lacked sufficient agricultural lands to support its inhabitants, and the

1 Yavapai were forced to return to their mountains to hunt and gather for part of the year. In 1873,
2 a relatively successful reservation was established at Rio Verde, but in 1875 its inhabitants were
3 forced to march to the San Carlos Apache reservation, with much loss of life. Resources at
4 San Carlos proved insufficient to support the newcomers, many of whom were eventually
5 allowed to leave during the 1880s and 1890s, while some intermarried with the Apaches and
6 remained. Subsequently, reservations were established for the Yavapai at Fort McDowell,
7 Camp Verde, Middle Verde, Clarkdale, and Prescott. All of these lie well east of the proposed
8 SEZ. In the end, the Tolkapayas were the only subtribe for whom no reservation was established.
9 The reservations proved to provide insufficient resources to support the populations for which
10 they were intended. Yavapais, no longer able to support themselves in their traditional manner,
11 took up wage labor outside their reservations, working as miners, ranch hands, and domestic
12 servants. Those remaining on the reservations struggled to retain sufficient water rights for their
13 own agricultural needs. Camp Verde, Middle Verde, and Clarkdale organized with a single
14 council under the Indian Reorganization Act of 1934. Fort McDowell established a constitution
15 under the same act and was successfully able to block the construction of the Orme Dam at the
16 confluence of the Salt and Verde Rivers. The dam would have flooded 65% of the reservation,
17 including all agricultural land. The Fort McDowell Reservation was also able to establish a
18 casino (Fort McDowell Yavapai Nation 2010). The Prescott Reservation organized under the
19 Article of Association in 1962 (Confederation of American Indians 1986; Khera and
20 Mariella 1983; Mariella and Khera 1984a,b; Mitchell 1984).

23 **Quechan**

24
25 Sometimes referred to as the Yuma, the Quechan (Kwatsan) are a Yuman-speaking group
26 closely allied with the Mohave, traditionally centered at the confluence of the Gila and Colorado
27 Rivers. It is not clear when they arrived at the confluence. They were there by the 1770s but
28 were not mentioned by Francisco Vasquez de Coronado, who passed through the area in 1540.
29 Quechan tradition relates that the Tribe migrated south from the sacred mountain *Avikwaame*,
30 in the Newberry Mountains near Laughlin, Nevada. They are thought to have arrived at the
31 confluence sometime between the thirteenth and the eighteenth centuries. Traditionally, the
32 Quechan practiced floodplain horticulture, depending on the annual floods of the Colorado River
33 to replenish their fields with fresh silt. The fertility of the soil allowed multiple plantings and
34 harvests, which the Quechan supplemented by gathering plants from the desert and by fishing.
35 During the growing season they dispersed along the floodplains of the Colorado and the Gila
36 Rivers, moving to the upper terraces during the winter. The Quechan prospered using simple
37 technology. Their bows were simple and unbacked. Arrows often had no stone points. Digging
38 sticks served for planting maize, and clothing was minimal (Bee 1983).

39
40 While their settlements were dispersed and independent, the Quechan had a sense that
41 they were a Tribe, a nation occupying a specific territory. They acted together in warfare; with
42 their allies, the Mohave, they were often at odds with the Halchidhoma, the Maricopa, and the
43 Cocopah. They were on friendly terms with the Yavapai and gathered mountain resources in
44 Yavapai territory.

45

1 The confluence of the Gila and Colorado Rivers was an important crossing along the
2 Yuma Trail, which led to the coast. Important to the Spanish and later the Americans, the
3 Spanish established a mission there in 1779, only to have it destroyed by the Quechan and
4 Cahuilla two years later. The Hispanic connection remained important to the Quechan, who
5 desired Spanish trade goods, for which they exchanged slaves captured during raids on their
6 enemies (Knack 1981). Between 1826 and 1829 the Quechan joined the Mohave in driving out
7 the Halchidhoma, who controlled another important river crossing. For a time, some Quechan
8 moved into the Blythe, California area, but they had returned south by the second half of the
9 nineteenth century (Bee 1983). After the defeat of Mexico in 1848, the United States established
10 a fort at Yuma to control the crossing, which had become an important wagon road. A
11 reservation was established for the Quechan in 1884.

14 **Mohave**

16 The Mohave were primarily at home along the Colorado River, from time to time
17 extending as far south as Blythe, California. They appear to have entered the Mohave Valley
18 sometime around A.D. 1150. They resided chiefly along the eastern bank of the Colorado, but
19 travelled widely, for trade, to harvest seasonally available resources, and out of curiosity. They
20 had sprawling settlements, rather than villages, with houses situated on low hills above the
21 floodplain. They did not engage in irrigation agriculture, but relied on seasonal inundation to
22 water and refresh their fields. Unlike most other Colorado Desert Tribes, families owned
23 individual fields and individual mesquite trees (Stewart 1983). Most of the year the Mohave
24 lived on terraces above the Colorado River, moving to the floodplain in the spring to plant
25 crops after seasonal floods receded (Kroeber 1925).

27 The Mohave have traditionally thought of themselves as a nation inhabiting a territory
28 under a hereditary great chief of the Malika clan. Divided into patrilineal clans, they came
29 together for warfare and other purposes. War leaders and shaman had great influence, and
30 power was gained by dreaming, often in sacred locations (Stewart 1983).

33 **Halchidhoma**

35 The Halchidhoma were a Yuman-speaking group who were once located south of the
36 Mohave along the Colorado River. Like the Mohave they were floodplain cultivators and active
37 traders. Culturally they were similar to the Mohave and the Quechan, but politically they were
38 their enemies. Their ties were with the Maricopa and Cocopah, also Yuman speakers. Like the
39 Mohave they were great travelers and traders, establishing the Cocomaricopa or Halchidhoma
40 Trail, an east–west route later followed by Euro-American immigrants. Their clashes with the
41 Mohave and Quechan came to a head sometime around 1825. The Halchidhoma were defeated
42 and began to move to the Gila River to join their Maricopa allies. This process continued until
43 1840 (Harwell and Kelly 1983). The Yavapai were initially involved in their expulsion. The
44 extent of friendly interaction is questionable.

1 **8.1.17.1.3 History**
2

3 After Christopher Columbus landed in the Caribbean in 1492, Spanish exploration of
4 the Americas quickly ensued, with Spain claiming vast tracts of land in the New World in the
5 name of King Ferdinand and Queen Isabella. There is some debate as to which of the Spanish
6 explorers made the first entry into Arizona. Some historians believe it was Alvar Nunez Cabeza
7 de Vaca, a Spaniard who shipwrecked off of the coast of Texas in 1528, and developed friendly
8 relations with the Native Americans, who then helped guide him to Mexico City. It has been
9 suggested that Cabeza de Vaca may have passed through the southeastern corner of Arizona on
10 his travels, but because he did not have any way of recording where he was, his exact route is
11 unknown. Cabeza de Vaca is important to the history of Arizona not only because he may have
12 been the first European presence in the state, but also because he claimed to have been told about
13 and seen the “Seven Cities of Cibola,” fictitious cities that were full of gold and wealth, ripe for
14 Spanish plundering. When Cabeza de Vaca eventually arrived in Mexico City in 1536, he spread
15 the rumors of these fabled cities, which led to the desire of other Spaniards to search for riches,
16 in the hopes of finding another civilization rich in gold similar to the Aztec in Mexico. The first
17 documented expedition into what is today Arizona was made under the expedition headed by
18 Fray Marcos de Niza in 1539. Fray Marcos de Niza wanted to assure the Native Americans that
19 he encountered on his expedition that they would be treated well, as news of the poor treatment
20 of Native Americans by the European explorers had preceded the actual presence of the
21 explorers. Accompanying Fray Marcos was an African slave, Estebanico, who had survived the
22 journey along with Cabeza de Vaca, and Francisco Vazquez de Coronado, the governor of a
23 northern Mexican province. After stopping in Mexico at Vacapa, Fray Marcos sent Estebanico
24 ahead with orders to scout the area and wait for the rest of the explorers. Estebanico did not heed
25 Fray Marcos’ orders and entered into Arizona, where he may have reached the Piman villages
26 near Tucson, before heading farther north to the Zuni pueblo, Cibola. Estebanico was killed by
27 the Zuni, and Fray Marcos followed his trail north, claiming all the land along the way in the
28 name of New Spain. He claimed to have made his way to Cibola and, after returning to Mexico
29 City, claimed to have seen vast riches at the city. In 1540, Francisco Vasquez de Coronado led
30 an expedition to officially lay claim to these rumored cities of gold and led his expedition into
31 eastern Arizona, following the Sonora and San Pedro Rivers and then into New Mexico, and may
32 have made his way as far as Kansas before heading back to Mexico City empty-handed. Also
33 funded by the Coronado expedition was Hernando de Alarcon, who sailed up the Gulf Coast of
34 California and explored the Colorado delta area, perhaps going as far north as the Gila and
35 Colorado River confluence. When Coronado came back without any gold or any prospects for
36 further exploration, the Spanish stayed out of most of the hostile desert southwest for the next
37 40 years (BLM 2010b; Farish 1915; Kessell 2002; Sheridan 1995).
38

39 Antonio de Espejo explored portions of northern and central Arizona in 1583 in an effort
40 to find precious metals. Espejo traded with the Hopi and discovered silver and copper deposits
41 east of Prescott, Arizona, about 96 mi (155 km) northeast of the proposed Brenda SEZ. In 1604
42 Juan de Onate, a Mexican-born Spaniard who had settled in northern New Mexico, explored
43 portions of Arizona north of the SEZ along the Bill Williams Fork, to its confluence with the
44 Colorado River, and followed the Colorado River south to the Gulf of California, likely coming
45 within 30 mi (50 km) west of the proposed Brenda SEZ (Kessell 2002; Sheridan 1995).
46

1 The Spanish did not maintain an established presence in Arizona, other than a few short-
2 lived missions in the south central portion of the state, until the discovery of large silver deposits
3 near Nogales in 1736, 230 mi (371 km) to the southeast of the proposed Brenda SEZ. Most of the
4 prospectors who came to mine the silver and stayed in Arizona were forced to make their living
5 as subsistence farmers and ranchers, as mining did not prove lucrative for another 100 years.
6 The first permanent Spanish settlement in Arizona was at Tubac, just north of Nogales, in an
7 effort to prevent uprisings of the O’odham Tribe. The Spanish attempted to build permanent
8 settlements along the Lower Colorado River, but hostile Yuman Tribes prevented any sustained
9 development. With Apache hostility in the northern and eastern portion of the state, Spanish
10 settlement was basically restricted to the Tucson area and south (Kessell 2002; Sheridan 1995).

11
12 Missionary explorer Eusebio Francisco Kino made nine different expeditions into the
13 territories of California and Arizona, establishing relationships with the Yuman and Piman
14 groups in the area, likely traversing the lower Colorado to the west of the proposed Brenda SEZ.
15 In 1775 Juan Batista de Anza was authorized by the viceroy of New Spain to lead a group of
16 settlers from Tubac to the San Francisco Bay area. De Anza set out along the Santa Cruz River,
17 which he followed to the Gila and Colorado confluence, and then into California. This expedition
18 established a trail that eventually became a congressionally designated National Historic Trail,
19 passing about 62 mi (100 km) to the south of the proposed Brenda SEZ.

20
21 In 1810 Mexicans declared their independence from Spanish colonial rule and in 1821
22 won the war. Mexican authority and control in Arizona was disjointed, and often states would
23 act independently from the rest of the country. Increasingly tense relations between Native
24 Americans and the non-Native occupiers were intensified with the expansion of ranchers and
25 homesteaders into Native American areas, leading to several conflicts. The Mexican-American
26 War began in 1846 with the United States eyeing the Rio Grande River and California Territory.
27 Two years later the Treaty of Guadalupe Hidalgo was signed, giving the United States control of
28 Texas, New Mexico (which included Arizona north of the Gila River), and California. When the
29 Gadsen Purchase was made in 1854, the United States gained control of Arizona south of the
30 Gila, and the Mesilla Valley of New Mexico; settlement of the area increased to unseen levels
31 (Kessell 2002; Sheridan 1995).

32
33 Prior to the Mexican-American War, Americans had ventured into Arizona on fur-
34 trapping expeditions. The first known American fur-trappers in Arizona were Sylvester Pattie
35 and his son James in 1825, trapping along the San Francisco, Gila, and San Pedro Rivers, in
36 the southeastern portion of Arizona. Frequent hostilities broke out between Native Americans
37 and fur trappers, but the trappers did not remain in the state long enough to make much of an
38 economic or ecological impact. One of the first of the largest U.S. expeditions to cross Arizona
39 at the time was made by the Mormon Battalion in 1846. Led by Lieutenant Colonel Phillip St.
40 George Cooke, the group intended to establish a wagon trail across the southern Great Plains and
41 the Southwest. The Mormon Battalion was the first representative of the U.S. Government to
42 encounter the Mexican population of Arizona, a nonconfrontational meeting. The trail that the
43 Mormon Battalion took later became a part of the Gila Route, or Southern Overland Route, a
44 network of Native American and European trails that entered the state in the east, converged on
45 the Pima villages on the Gila River, and traversed the Gila River floodplain to the Colorado and
46 Gila River confluence (Sheridan 1995).

1 Most occupation of Arizona after the acquisition of the territory by the U.S. Government
2 was concentrated in the southern part of the state in mining ventures. It was not until the
3 establishment of Fort Yuma on the California side of the Colorado River, and other nearby
4 military garrisons (Camp Colorado near Parker and Camp Date Creek near La Paz), that
5 Americans began to settle in the region near the proposed Brenda SEZ. The forts provided the
6 necessary security against Native Americans, who resented the American occupation of their
7 land and who were competing for the same resources as the miners and ranchers settling in the
8 desert. After the start of the Civil War, most of the military personnel in Arizona were
9 withdrawn, leaving the settlers to their own defenses until the end of the war (Sheridan 1995;
10 Stone 1982).

11
12 In 1857, 20 mi (32 km) up the Gila River from the Colorado junction, Arizona's first
13 boomtown, Gila City, was established after a gold strike. The largest and most prosperous gold
14 mine in Arizona occurred at Vulture Mine, near Wickenburg, about 65 mi (105 km) northeast of
15 the proposed Brenda SEZ. The creation of canals, roads, and other infrastructure developments
16 helped to increase the population of Arizona and their ability to grow crops, export and import
17 their goods, and to maintain the mines. The Phoenix Stage Route was established as part of this
18 infrastructure, leading to Wickenburg becoming a transportation hub and the headquarters of
19 the Arizona-California Stage Company. During the 1870s, copper, silver, gold, and other less
20 valuable minerals were mined fervently throughout the state, and with the construction of
21 railroads in 1881 and 1882, mining only increased. The Atchison, Topeka and Santa Fe Railroad
22 was a key rail line that connected major cities in the American West, and a branch of this
23 railroad passes just 4 mi (7 km) east of the proposed Brenda SEZ. Much of the early mining in
24 Arizona was undertaken in Yuma County, and by 1910, Arizona was the largest producer of
25 copper in the United States and continues to be so. In the vicinity of the proposed Brenda SEZ,
26 mining occurred in the Bear Hills, just to the south of the SEZ, as well as in the Plomosa
27 Mountains to the west and the Granite Wash Mountains and the Little Harquahala Mountains to
28 the east (Sheridan 1995; Stone 1982).

29
30 Settlement, ranching, and mining in Arizona are dependent upon water regulation and
31 dispersal, and consequently water control projects were started early in the development of
32 Arizona. Often prehistoric canals were used and/or expanded in order to facilitate water usage.
33 People would generally settle only in places where water was available. One of the earliest land
34 scams in which people were conned into settling into an area with the promise of canals to be
35 built occurred just north and east of the proposed Brenda SEZ, in the Bouse Wash area. In the
36 late 1920s, two men from Los Angeles convinced several hundred families to move into the
37 Bouse Wash area with the promise that canals would be constructed from the soon-to-be-built
38 Hoover Dam. The canal system never materialized; the con-men were prosecuted; and by 1945
39 only six families remained in the area. Located immediately west of the SEZ are historic
40 ranching structures, the Plomosa Windmill, cattle tank, and corral; however, whether this was
41 affiliated with the Bouse Wash land scam or is the result of an independent homesteader is not
42 known at this time. The Central Arizona Project (CAP) is a 336-mi (541-km) aqueduct that starts
43 in Lake Havasu and stretches to the south of Tucson. Initial construction on the CAP began in
44 1973, and it was completed in 1993, delivering 1.5 million ac-ft (1.9 billion m³) of water per
45 year. Portions of the CAP pass just 4 mi (7 km) east of the proposed Brenda SEZ (Stone 1982).

1 In 1942, the U.S. Army identified 18,000 mi² (46,000 km²) of desert in California and
2 Arizona as a training area for troops in a desert environment in preparation for combat in
3 North Africa. In 1943, the area came to be known as the Desert Training Center/California-
4 Arizona Maneuver area, or Desert Training Center/California–Arizona Maneuver Area
5 (DTC/C-AMA), as the massive training facility expanded its size to 31,500 mi² (81,600 km²)
6 and its range of activities from training troops to testing and developing equipment and supplies
7 and to developing new techniques and tactics for desert warfare to large-scale training and
8 maneuvering. It is estimated that more than 1 million men trained at the DTC/C-AMA. Although
9 it operated only between 1942 and 1944, it represents a significant period in the nation’s history
10 and contains a number of archaeological features of importance, including remains of training
11 camps, airfields, bivouacs, maneuver areas, and tank tracks (Bischoff 2000).

12
13 In a larger context, the DTC/C-AMA was a part of the early days of U.S. involvement in
14 World War II. The German army was advancing across Europe, and the Italian army had struck
15 out in Libya and Egypt. British forces had been able to successfully counterattack the Italian
16 army, but this resulted in Germany entering North Africa to help the Italians. General Erwin
17 Rommel of the German army was successfully advancing his desert army across Libya and then
18 into Egypt against the British. The prospect of Germany and Italy controlling Egypt and the
19 Japanese successes in India, propelling them toward Persia, leaving Russia wide open to attack,
20 made it clear to the United States that the country would need to go to North Africa. General
21 Lesley J. McNair, chief of staff for the Army General Headquarters, recognized the need for
22 preparing American soldiers for desert warfare in a terrain similar to that of North Africa. He
23 placed Major General George S. Patton Jr., who had previously conducted successful training
24 maneuvers in Louisiana, in charge of the desert training center project (Bischoff 2000).

25
26 The location of the Desert Training Center was determined in March 1942, as General
27 Patton toured the desert. Aside from the mountain ranges, the uninhabited desert of eastern
28 California and western Arizona was deemed sufficiently similar to that of North Africa. Patton
29 thought the area was ideal for large-scale training exercises, because it was remote and desolate
30 yet water was available and three railroads supplied the area. In addition there were other
31 military facilities nearby (in Riverside, Las Vegas, Indio, Yuma, and Blythe). Patton worked out
32 deals with the railroad companies (UP, Santa Fe, and Southern Pacific) and the Municipal Water
33 District in order to supply transportation and water for the troops. Camp Young was the first
34 camp established near Blythe, and it became the DTC headquarters. Several other camps were
35 constructed over the course of the duration of the DTC/C-AMA operation. The camps were
36 temporary in nature, constructed mostly of tents with some wooden structures to house
37 administrative centers or hospitals. The only permanent construction was open-air chapels and
38 large relief maps. Associated with most of the camps were maneuver areas, rock-lined insignias,
39 and arms ranges. By late summer 1942, Patton was ordered to North Africa under operation
40 Torch, where he successfully commanded the western task force of the operation to victory. The
41 DTC/C-AMA was quickly placed under the command of Major General Alvan Gillem, and the
42 first set of maneuvers was conducted in the fall. This first set of maneuvers was considered
43 unrealistic, and the DTC was ordered to act like a theater of operations in a combat setting,
44 including the establishment of communication zones and combat zones. This was the first time
45 the Army simulated a theater of operation. Riverine operations across the Colorado River were
46 also added. At its height the DTC contained 14 camps, with 11 in California and 3 in Arizona,

1 each capable of holding at least 15,000 soldiers during a typical 14-week training schedule.
2 There were also airfields, hospitals, supply depots, and railheads. The importance of air support
3 should not be overlooked, as it was seen as an integral part of the desert training experience.
4 On-the-ground troops needed to be able to conceal themselves as much as possible to prevent
5 detection during simulated air attacks. In 1943 as the need for desert training waned with the
6 close of the North African campaign, the concept and name of the DTC changed to the C-AMA.
7 Its mission was to conduct broader based large-scale training to toughen soldiers mentally and
8 physically and provide battle conditions for conducting firing training and for testing and
9 developing equipment, supplies, and training methods. The DTC/C-AMA saw its greatest
10 amount of activity the summer and fall of 1943. In late 1943 personnel shortages (due to needs
11 for personnel overseas) resulted in inefficient operation of the DTC/C-AMA, and General
12 McNair recommended the facility be closed. The DTC/C-AMA was declared surplus in
13 April 1944 by the War Department and was closed by the end of the month (Bischoff 2000).
14

15 There were three camps established in Arizona for the purposes of the DTC/CAMA.
16 Camp Bouse, an artillery range base, was the closest camp to the SEZ, about 20 mi (33 km) to
17 the north. Camp Horn and Camp Hyder were located south of the SEZ near Dateland and Hyder,
18 Arizona, respectively. Also associated with the DTC/CAMA in Arizona was the Poston Japanese
19 relocation camp, near Parker, Arizona, and the Yuma Testing Branch. The Yuma Testing Branch
20 was an army testing operation of pontoon bridges and a training facility for engineers in building
21 roads. Associated with the Yuma Testing Branch was Camp Laguna, the purpose of which was
22 to train troops in mechanized warfare. The Luke Air Force Base was created as part of the
23 DTC/CAMA northeast of Phoenix to train pilots. More than 12,000 pilots were trained here for
24 World War II, and it continues to operate as a training facility. Also part of the Luke Air Force
25 Base are the Barry M. Goldwater Range and the Gila Bend Auxiliary Air Field. These Air Force
26 ranges also serve as training facilities for the U.S. Air Force in air-to-air training and air-to-gun
27 training. The portion of the Luke Air Force Base complex closest to the proposed Brenda SEZ is
28 about 72 mi (116 km) to the southeast, although the Brenda SEZ is within the U.S. Department
29 of Defense's (DoD's) Airspace Consultation Area (Bischoff 2000; Stone 1982).
30

31 The Yuma Proving Ground (YPG) was established in 1963, covering 990,000 acres
32 (4,006 km²) north of the Gila River, the closest portion to the proposed Brenda SEZ being about
33 34 mi (55 km) to the southwest. While the YPG was not established until the mid-twentieth
34 century, the presence of the U.S. Army in the Yuma area has been felt since the construction of
35 the first fort there in 1850, and subsequent periodic occupation of the area by the military. The
36 YPG consists of the Yuma Test Center, the Tropic Regions Test Center, and the Cold Regions
37 Test Center, each center specializing in a specific type of military testing. The purpose of the
38 YPG is as a test facility for all branches of the military, from artillery and bomb testing to
39 automotive and helicopter tests (Stone 1982; Wullenjohn 2010).
40

41 ***8.1.17.1.4 Traditional Cultural Properties—Landscape***

42
43
44 The Yavapai consider their traditional use area to be sacred land—the land where the
45 Yavapai first emerged and the land that they are divinely required to protect. This sacred
46 landscape is composed of an interrelated complex of important plants, animals, and places of

1 power, tied together by a network of trails linking the Colorado and Gila Valleys (Stone 1986).
2 From the Yavapai point of view, places, features, and artifacts of power are dangerous and can
3 be handled, discussed, or visited safely only by powerful religious practitioners. Their locations
4 and properties are not discussed openly. Many Yavapai are leery of “New Age” appropriation
5 of Native spirituality and places of power (Ivakhiv 2001). Because the Yavapai reservations are
6 located in the eastern part of their former traditional range and because many knowledgeable
7 elders, familiar with the western part of their traditional territory, have passed away, over the
8 years knowledge of ancestral places of power in the western part of Yavapai territory has been
9 lost. Without specific knowledge, any artifacts of the past from these areas have the potential
10 for being powerful and should be treated with respect (Bean et al. 1978).

11
12 Places of power include caves, mountains, and small rock shrines. Certain minerals were
13 also thought to be imbued with power, particularly turquoise (Gifford 1936). Many of the most
14 important Yavapai sacred places are located well to the east of the SEZ near Sedona and the
15 Verde River. Montezuma Well, a spring-fed lake in a limestone sink now located in Montezuma
16 Castle National Monument 135 mi (217 km) to the northeast, is considered by the Yavapai to be
17 the place where their ancestors first emerged into this world. A cave in Boynton Canyon, 140 mi
18 (226 km) to the northeast, located in the Sedona Red Rock Mountains of the Coconino National
19 Forest, is the most sacred Yavapai site, the place where First Woman, the only survivor of the
20 destruction of the third world according to Yavapai cosmology, lived. Mountains in general may
21 be the home of the *qaqáqə*, or “little people,” who may be called on for help in times of distress
22 (Khera and Mariella 1983).

23
24 The Ranegras Plains, where the proposed Brenda SEZ is located, and surrounding
25 mountains and valleys are areas where the Western Yavapai hunted and gathered. An aboriginal
26 travel route from the Colorado River follows Bouse Wash along the Ranegras Plain about as far
27 as the SEZ and then proceeds east through Granite Wash Pass to Centennial Wash, which it
28 follows to the Gila River (Stone 1986). The Hakehelapa or Wiltaikapaya Band of the Western
29 Yavapai were centered in the Harquahala and Harcuvar Mountains, 17 mi (28 km) and 12 mi
30 (20 km) miles northeast of the proposed SEZ, respectively (Gifford 1936). Both ranges were
31 well-watered and provided a variety of resources not available on the desert floor, as well as
32 Bighorn Sheep habitat (BLM 2008b). The Granite Wash Mountains, northeast of the SEZ,
33 links the two ranges and provides a bighorn migration route (BLM 2006) The Harquahala
34 Mountains provide a “Sky Island,” dominating the skyline for up to 100 mi (161 km) around.
35 Archaeological remains likely resulting from Yavapai occupation are among the reasons it has
36 been designated an ACEC including a Special Cultural Resource Management Areas (SCRMA).
37 The Black Butte ACEC, located about 6 mi (10 km) to the east, was a local source of obsidian
38 used for stone tools (BLM 2008b, 2010d). Evidence of Native American use of the Harcuvar
39 Mountains includes camp sites, tool manufacturing areas, milling areas, rockshelters and rock
40 art, pictographs as well as petroglyphs, and crystals and minerals important to Native Americans
41 (BLM 2006, 2008b). Two SCRMA have been established there (BLM 2007a). The SEZ is
42 bordered on the southwest by the Plomosa Mountains, where petroglyph and lithic procurement
43 sites have been reported (BLM 2006). It is 14 mi (23 km) north of the Kofa Mountains, also an
44 area frequented by the Western Yavapai (Bean et al. 1978). As part of the traditional use area of
45 the Western Yavapai, any archaeological sites associated with Native American populations,

1 rock art panels such as those found at Granite Wash Pass, shrines, or geoglyphs found in the area
2 are likely to be constituent parts of a cultural landscape important to the Yavapai.

3 4 5 **8.1.17.1.5 Cultural Surveys and Known Archaeological and Historical Resources** 6

7 No cultural resource surveys have been conducted in the proposed Brenda SEZ, and
8 therefore no cultural resources have been identified in the boundaries of the SEZ. However,
9 within 5 mi (8 km) of the SEZ, 25 surveys have been conducted, resulting in the recording of
10 37 sites, 10 of which are prehistoric, 18 historic, 1 multicomponent, and 9 of an unknown
11 temporal identification.

12
13 The BLM has designated several ACECs in the vicinity of the proposed Brenda SEZ,
14 because these areas have been determined to be rich in cultural resources. Located about 9 mi
15 (14 km) southwest of the SEZ is the Dripping Springs ACEC. This multicomponent ACEC
16 consists of large boulders with petroglyphs, as well as a two-room stone cabin. Located about
17 27 mi (43 km) north of the SEZ is the Swansea Historic District ACEC. Swansea was a mining
18 district that saw its first prospectors in 1862, and the town became a part of the Arizona and
19 Swansea Railroad in the early twentieth century. The Harquahala ACEC is situated about 24 mi
20 (38 km) east of the SEZ and has been designated as an ACEC in order to protect its cultural
21 resources and the historic Harquahala Peak Observatory. Several additional ACECs are located
22 in excess of 25 mi (40 km) from the SEZ, but are relevant to resources in the region. The Big
23 Marias ACEC is situated about 37 mi (59 km) west of the SEZ, along the Colorado River. This
24 ACEC is made up of the single greatest concentration of geoglyphs in North America. The Sears
25 Point ACEC is 60 mi (97 km) southeast of the proposed Brenda SEZ. This ACEC consists of the
26 Sears Point Archaeological District, which is listed on the NRHP, and contains archaeological
27 evidence for Archaic through Patayan and Hohokam occupation, in addition to rock art. Also a
28 part of this ACEC is an historic travel corridor; the Juan Batista de Anza National Historic Trail,
29 the Butterfield Overland Mail Route, the Mormon Battalion Trail, and the Gila Route pass
30 through this ACEC.

31
32 The BLM has also identified SCRMA close to the proposed Brenda SEZ, but only one
33 of them is located within 25 mi (40 km) of the SEZ. The Harcuvar Mountain West SCRMA is
34 located just 18 mi (29 km) to the northeast. Swansea, 27 mi (43 km) from the SEZ is also a
35 SCRMA, in addition to its ACEC designation. The Harcuvar Mountain East SCRMA is 38 mi
36 (61 km) to the northeast. Contained within the Big Marias ACEC is the Big Maria Terraces
37 SCRMA, designated to protect the valuable geoglyphs from destruction. The Cibola Valley
38 SCRMA is situated about 49 mi (79 km) southwest of the SEZ, an area valued for its cleared
39 circles, rock alignments, circular mounds, trail networks, lithic scatters, intaglios, and
40 petroglyphs. On the western side of the Colorado River is the Palo Verde Point SCRMA, 53 mi
41 (85 km) southwest of the SEZ, an area unique in the pristine condition of its desert pavement
42 sites, intaglios, petroglyphs, trail networks, rock alignments, cleared areas, and widespread lithic
43 scatters. The Walkers Camp SCRMA, 56 mi (90 km) southwest of the SEZ, shows evidence of
44 year-round occupation by Native Americans, along with desert pavement features and artifact
45 scatters. This SCRMA also contains portions of the *Xam Kwitcam* migratory trail that pass
46 through the area. The Harquahala SCRMA is a culturally sensitive area, almost entirely

1 contained within the boundaries of the Harquahala ACEC. These SCRMA's are designated to
2 conserve the sites or traditional use areas by Native Americans, in an effort to develop and
3 interpret the sites for public visitation (BLM 2007a, 2010c). Also in the vicinity of the proposed
4 Brenda SEZ are YPG and Luke Air Force Base (and associated ranges), which have contributed
5 to the overall history and context of the region.
6
7

8 ***National Register of Historic Places*** 9

10 There are no historic properties listed in the NRHP in or within 5 mi (8 km) of the SEZ.
11 However, several sites within 5 mi (8 km) of the SEZ are considered potentially eligible for
12 inclusion in the NRHP. Three of these potentially eligible sites are prehistoric in nature, one is
13 multicomponent, and seven are historic. One site is a prehistoric trail with associated ceramic
14 sherds, located east of the SEZ. A second site is also situated east of the SEZ, consisting of a
15 concentration of 10 rock rings. Another rock ring is situated northeast of the SEZ. The
16 multicomponent site is an extensive prehistoric lithic scatter consisting of three different loci of
17 activity, as well as an historic trash scatter associated with another site, one of the homesteads.
18 Five sites are historic homesteads. One site is an historic homestead and historic church, and
19 another is a temporary historic camp that likely dates to the 1920s. Several of the prehistoric sites
20 within 5 mi (8 km) of the SEZ have not been evaluated for inclusion in the NRHP and, if
21 evaluated to be significant cultural resources, could increase the total number of eligible sites in
22 the 5-mi (8-km) boundary.¹⁴
23

24 Eight properties are listed in the NRHP in La Paz County, the closest properties being the
25 Rhoda Nohlechek House, 20 mi (32 km) east in Wenden, Arizona, and the Harquahala Peak
26 Observatory and Historic District, 29 mi (47 km) east in the Harquahala Mountains in Gladden,
27 Arizona. Six other NRHP-listed properties are in Parker, Arizona, 36 mi (58 km) northwest,
28 Ehrenberg, Arizona, 38 mi (61 km) west, and Hyder, Arizona, 57 mi (92 km) south.
29
30

31 **8.1.17.2 Impacts** 32

33 Direct impacts on significant cultural resources could occur in the proposed Brenda
34 SEZ; however, further investigation is needed because no cultural resource surveys have been
35 conducted within the boundaries of the SEZ. A cultural resources survey of the entire area of
36 potential effect (APE) of a proposed project would first need to be conducted to identify
37 archaeological sites, historic structures and features, and traditional cultural properties, and an
38 evaluation would need to follow to determine whether any are eligible for listing in the NRHP.
39 The proposed Brenda SEZ has potential for containing prehistoric sites, especially in the eastern
40 portion of the SEZ, as the Bouse Wash may have provided access to water and riparian resources
41 during environmental conditions that were favorable for exploitation of the area. Additionally,
42 some lithic materials/flakes were observed there during a preliminary site visit, further indicating
43 the potential presence of significant prehistoric cultural resources. The potential for historic

¹⁴ Source of data is a file search on AZSITE: Arizona's Cultural Resource Inventory, run by the Arizona State Museum, conducted on Dec. 11, 2009, and July 15, 2010.

1 resources also exists, with DTC/C-AMA activity and ranching/homesteading known to have
2 occurred in the area. Possible impacts from solar energy development on cultural resources that
3 are encountered within the SEZ or along related ROWs, as well as general mitigation measures,
4 are described in more detail in Section 5.15. Impacts would be minimized through the
5 implementation of required programmatic design features as described in Appendix A,
6 Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and
7 consultations will occur.
8

9 Programmatic design features to reduce water runoff and sedimentation would prevent
10 the likelihood of indirect impacts on cultural resources resulting from erosion outside the SEZ
11 boundary (including along ROWs).
12

13 The nearest transmission line corridor is approximately 19 mi (31 km) to the west, which,
14 if a new corridor was constructed to it, would result in the disturbance of 575 acres (2.3 km²).
15 The transmission line corridor assessed in this PEIS would run from the southwest corner of the
16 proposed Brenda SEZ to U.S. 60, at which point it would run alongside U.S. 60, to its junction
17 with I-10, and then connect to the transmission line near U.S. 93. Impacts on cultural resources
18 are possible in areas related to the ROW, because new areas of potential cultural significance
19 could be directly affected by construction or opened to increased access from use. Indirect
20 impacts, such as vandalism or theft, could occur if significant resources are close to the ROW.
21 This designated energy corridor may affect known cultural resources; however, because the
22 corridor is adjacent to existing highways, the impacts on these resources would be minimal as the
23 resources have likely been affected by previous disturbance activities. Programmatic design
24 features assume that the necessary surveys, evaluations, and consultations for the ROW will
25 occur, as for the project footprint within the SEZ. No needs for new access roads have currently
26 been identified, assuming existing roads would be used; therefore, no additional areas of cultural
27 concern would be made accessible as a result of development within the proposed Brenda SEZ.
28 However, impacts on cultural resources related to the creation of new corridors not assessed in
29 this PEIS would be evaluated at the project-specific level if new road or transmission
30 construction or line upgrades were to occur.
31
32

33 **8.1.17.3 SEZ-Specific Design Features and Design Feature Effectiveness** 34

35 Programmatic design features to mitigate adverse effects on significant cultural
36 resources, such as avoidance of significant sites and features and cultural awareness training for
37 the workforce, are provided in Appendix A, Section A.2.2.
38

39 SEZ-specific design features would be determined in consultation with the Arizona
40 SHPO and affected Tribes following the completion of cultural surveys.
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1 **8.1.18 Native American Concerns**

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3 As discussed in Section 8.1.17, Native Americans tend to view their environment
4 holistically and share many environmental and socioeconomic concerns with other ethnic groups.
5 For a discussion of issues of possible Native American concern shared with the population as a
6 whole, several sections in this PEIS should be consulted. General topics of concern are addressed
7 in Section 4.16. Specifically for the proposed Brenda SEZ, Section 8.1.17 discusses
8 archaeological sites, structures, landscapes, trails, and traditional cultural properties;
9 Section 8.1.8 discusses mineral resources; Section 8.1.9.1.3 discusses water rights and water use;
10 Section 8.1.10 discusses plant species; Section 8.1.11 discusses wildlife species, including
11 wildlife migration patterns; Section 8.1.13 discusses air quality; Section 8.1.14 discusses visual
12 resources; Sections 8.1.19 and 8.1.20 discuss socioeconomics and environmental justice,
13 respectively; and issues of human health and safety are discussed in Section 5.21. This section
14 focuses on concerns that are specific to Native Americans and to which Native Americans bring
15 a distinct perspective.

16
17 All federally recognized Tribes with traditional ties to the proposed Brenda SEZ have
18 been contacted so that they could identify their concerns about solar energy development.
19 The Tribes contacted with traditional ties to the Brenda SEZ are listed in Table 8.1.18-1.
20 Appendix K lists all federally recognized Tribes contacted for this PEIS.

21
22
23 **8.1.18.1 Affected Environment**

24
25 The territorial boundaries of the Tribes that inhabited the Sonoran Desert appear to have
26 been fluid over time. Depending on existing relationships or amity or enmity, resources were
27 shared where abundant. The proposed Brenda SEZ lies within the traditional range of the
28 Western Yavapai, but was accessible to the Quechan and the Mohave with whom they were
29 on friendly terms. The Indian Claims Commission included the area in the Yavapai traditional
30 territory (Royster 2008).

31
32 **TABLE 8.1.18-1 Federally Recognized Tribes with Traditional Ties to
the Proposed Brenda SEZ**

Tribe	Location	State
Cocopah Indian Tribe	Somerton	Arizona
Colorado River Indian Tribes	Parker	Arizona
Fort McDowell Yavapai Nation	Fountain Hills	Arizona
Fort Mojave Indian Tribe	Needles	California
Quechan Indian Tribe of the Fort Yuma Reservation	Yuma	Arizona
Salt River Pima-Maricopa Indian Community	Scottsdale	Arizona
San Carlos Apache Tribe	San Carlos	Arizona
Yavapai-Apache Nation	Camp Verde	Arizona
Yavapai-Prescott Indian Tribe	Prescott	Arizona

1 **8.1.18.1.1 Territorial Boundaries**

2
3
4 **Yavapai**

5
6 The Western Yavapai or Tolkapya territory ranged from the mountains east of the
7 Colorado, eastward to the western slopes of Kirkland Valley, although Tolkapaya also
8 established gardens on the floodplain of the Colorado River adjacent to the Quechan. On the
9 north, they ranged into the mountains north of the Bill Williams and Santa Maria Rivers. On the
10 south they sometimes ranged as far as Yuma, but for the most part the mountains north of the
11 Gila River formed their southwestern boundary. On the southeast it extended to the Gila River
12 (Khera and Mariella 1983). Contrary to their relationships on their western border, they were not
13 on good terms with neighboring Tribes to the north and south. Yavapai descendants are found
14 primarily on the Fort McDowell, Camp Verde, Middle Verde, Clarkdale, and Prescott Yavapai
15 reservations, as well as on the Cocopah and San Carlos Apache reservations.
16

17
18 **Quechan**

19
20 The heart of Quechan territory lies at the confluence of the Gila and Colorado Rivers well
21 to the south of the SEZ. As presented to the Indian Claims Commission, their eastern boundary
22 extended along the crest of the mountains east of the Colorado River as far north as Blythe,
23 California, where it jogged westward to the channel of the Colorado River (ICC 1958). Quechan
24 descendants occupy the Fort Yuma Indian Reservation in Arizona and California.
25

26
27 **Mohave**

28
29 The Mohave claimed lands on both banks of the Colorado River to the crests of the
30 mountains from Black Canyon in the north as far south as the Dome Mountains, 22 mi (35 km)
31 west of the proposed SEZ, which were also frequented by the Western Yavapai, along with a
32 substantial area in southern California (CSRI 2002). Mohave descendants occupy the Fort
33 Mojave Indian Reservation near Needles, California, and can be found on the reservation of the
34 Colorado River Indian Tribes.
35

36
37 **Halchidhoma**

38
39 The Halchidhoma were forced off their lands along the Colorado River by neighboring
40 Tribes about 1827 before the United States acquired the area from Mexico. They probably
41 occupied territory around Blythe similar in extent to that claimed by the Mohave in that area.
42 Their descendants have been integrated into the Maricopa Tribe and can be found on the Salt
43 River Pima–Maricopa Indian Reservation in Arizona (Harwell and Kelly 1983).
44
45
46

1 **8.1.18.1.2 Plant Resources**
2

3 This section focuses on those Native American concerns with ecological as well as
4 cultural components. For many Native Americans, the taking of game or the gathering of plants
5 or other natural resources may have been seen as both a sacred and secular act (Bean. et al 1978;
6 Stoffle et al. 1990).
7

8 The traditional subsistence base shared by the Yavapai and the Quechan was a mixture
9 of floodplain agriculture and hunting and gathering. The proportion of farming to gathering
10 varied with the Tribe and the land they occupied. The proposed Brenda SEZ does not appear
11 to be well suited for indigenous agriculture, lacking a reliable water source. Rather, it lies in a
12 travel corridor connecting the Colorado River with the Gila River. It is a valley surrounded with
13 relatively well-watered mountains, where Western Yavapai were known to reside. Because of
14 the valley’s proximity to inhabited mountains, it is likely that the Yavapai gathered the plant
15 resources available there and hunted what game there was. While no archaeological surveys have
16 been conducted within the boundaries of the SEZ, petroglyph panels have been recorded in the
17 Dripping Springs ACEC in the Plomosa Mountains to the southwest, and in the Harcuvar and
18 Harquahala Mountains to the northeast (BLM 2006, 2008b). The latter have been identified as in
19 the heartland of a Western Yavapai band (Gifford 1936). The Yavapai and Quechan practiced a
20 seasonal round in harvesting naturally occurring plant resources. Native Americans commenting
21 on previous energy development projects in the area have voiced concern over the loss of
22 culturally important plants used for food, medicine, and ritual purposes and for making tools,
23 implements, and structures (Bean et al. 1978).
24

25 The plant communities observed or likely to be present in the proposed Brenda SEZ are
26 discussed in Section 8.1.10. As shown in the Gap analysis, the land cover at the proposed Brenda
27 SEZ is predominantly Sonora–Mojave Creosotebush–White Bursage Desert Scrub, interspersed
28 with patches of Sonoran–Paloverde Mixed Cacti Desert Scrub. There is also a pocket of Sonora–
29 Mojave Mixed Desert Scrub (USGS 2005a). While these communities appear sparse most of the
30 year, seasonal rains often result in an explosion of ephemeral herbaceous species.
31

32 Native American populations have traditionally made use of hundreds of native plants.
33 Table 8.1.18.1-1 lists plants often mentioned as important by Native Americans that were
34 either observed at the proposed Brenda SEZ or are probable members of the cover type plant
35 communities identified for the SEZ. These plants are the dominant species; however, other
36 plants important to Native Americans could occur in the SEZ, depending on localized conditions
37 and the season. Overall, creosotebush dominates the SEZ, while cacti, mesquite, and sparse
38 wild grasses are present. Creosotebush is important in traditional Native American medicine.
39 Mesquite was among the most important food plants. Its long, bean-like pods were harvested
40 in the summer, could be stored, and were widely traded. Its blossoms are edible. Saltbush and
41 buckwheat seeds were harvested, processed, and eaten. They, along with cactus fruit, were
42 harvested in the summer (Khera and Mariella 1983).
43
44

TABLE 8.1.18.1-1 Plant Species Important to Native Americans Observed or Likely To Be Present in the Proposed Brenda SEZ

Common Name	Scientific Name	Status
Food		
Buckwheat	<i>Eriogonum</i> spp.	Possible
Cholla Cactus	<i>Opuntia</i> spp.	Observed
Creosotebush	<i>Larrea tridentata</i>	Observed
Honey Mesquite	<i>Prosopis Glandolosa</i>	Possible
Jojoba	<i>Simmondsia chinensis</i>	Possible
Prickly Pear Cactus	<i>Opuntia</i> spp.	Possible
Saguaro Cactus	<i>Carnegiea gigantean</i>	Observed
Saltbush	<i>Atriplex</i> spp.	Possible
Screwbean Mesquite	<i>Prosopis pubescens</i>	Possible
Yellow Palo verde	<i>Parkinsonia microphylla</i>	Possible
Medicine		
Creosotebush	<i>Larrea tridentata</i>	Possible

Sources: Field visit; Gifford (1936); Khera and Mariella (1983); and USGS (2005a).

8.1.18.1.3 Other Resources

The proposed Brenda SEZ also may have been a hunting ground. The mountains surrounding the SEZ provide habitat for deer and bighorn sheep. Traditionally, deer have been an important source of both food and bone sinew and hide to make a variety of implements. Although pronghorn antelope were present on the Harquahala Plain, they were not hunted by the Yavapai. While big game was highly prized, smaller animals such as black-tailed jackrabbits and desert cottontail, both present in the SEZ, traditionally provided a larger proportion of the protein in their diets (Gifford 1936). Animal species important to Native Americans are shown in Table 8.1.18.1-2.

Mineral resources important to Native Americans in the Colorado Desert include turquoise, stone for making tools, and quartz crystals considered to have healing properties. Obsidian and quartz have been reported in the surrounding mountains (BLM 2006, 2008b).

As long-time desert dwellers, Native Americans have a great appreciation for the importance of water in a desert environment. They have expressed concern over the use and availability of water for solar energy installations (Jackson 2009).

In addition, Native Americans have expressed concern over ecological segmentation, that is, development that fragments animal habitat and does not provide corridors for movement. They would prefer solar energy development take place on land that has already been disturbed, such as abandoned farmland, rather than on undisturbed ground (Jackson 2009).

TABLE 8.1.18.1-2 Animal Species Used by Native Americans as Food Whose Range Includes the Proposed Brenda SEZ

Common Name	Scientific Name	Status
Mammals		
Badger	<i>Taxidea taxus</i>	All year
Bighorn sheep	<i>Ovis Canadensis</i>	All year
Black-tailed jackrabbit	<i>Lepus californicus</i>	All year
Bobcat	<i>Lynx rufus</i>	All year
Wood rats	<i>Neotoma spp.</i>	All year
Chipmunks	<i>Tamias spp.</i>	All year
Coyote	<i>Canis latrans</i>	All year
Desert cottontail	<i>Silvilagus audubonii</i>	All year
Kit fox	<i>Vulpes macotis</i>	All year
Mule deer	<i>Odocoileus hemionus</i>	All year
Rock squirrel	<i>Spermophilus variegates</i>	All year
Birds		
Gambel's Quail	<i>Callipepla gambelii</i>	Summer
Doves		
Inca dove	<i>Columbina inca</i>	All year
Common ground dove	<i>Columbina passerina</i>	All year
White-winged dove	<i>Zenaida asiatica</i>	Summer
Mourning dove	<i>Zenaida macroura</i>	All year
Reptiles		
Desert tortoise	<i>Gopherus agassizii</i>	All year
Chuckwalla	<i>Sauromalus ater</i>	Observed

Sources: Field visit; USGS (2005b); Gifford (1936).

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8.1.18.2 Impacts

To date, no comments have been received from the Tribes specifically referencing the proposed Brenda SEZ. However, in a response letter, the Quechan Indian Tribe of Fort Yuma indicates that some of the SEZs proposed in this PEIS lie within their Tribal Traditional Use Area. They stress the importance of evaluating impacts on landscapes as a whole. Because trails have both physical and spiritual components, from their perspective the intrusion of industrial development nearby would have negative effects on trails (Jackson 2009). Commenting on past transmission line projects in the area, the Quechan have expressed a general mistrust of irreversible development projects because of the loss of natural habitat, particularly as it would affect eagle and bighorn sheep populations (Bean et al. 1978). Commenting on the same project, rural Yavapai were much more concerned with wild plant resources and noted the dense stands of an important medicinal plant, creosotebush or *umi*, on the Ranegras Plains. Rural Yavapai expressed concerns for the following resources, in order of importance, game animals (deer, birds, rabbits, mountain sheep), viewshed, cremation or burial sites, wild food plants

1 (squawbush, prickly pear, saguaro), minerals, rock art, sacred areas, medicinal plants, and fiber
2 plants (Bean et al. 1978).

3
4 The impacts that would be expected from solar energy development within the proposed
5 Brenda SEZ on resources important to Native Americans fall into two major categories: impacts
6 on the landscape and impacts on discrete localized resources.

7
8 Potential landscape-scale impacts are those caused by the presence of an industrial
9 facility within a cultural landscape that includes sacred mountains and other geophysical features
10 tied together by a network of trails. Impacts may be visual, for example, the intrusion of an
11 industrial feature in sacred space; audible, for example, noise from the construction, operation, or
12 decommissioning of a facility, detracting from the traditional cultural values of the site; or
13 demographic, for example, the presence of a larger number of outsiders in the area, increasing
14 the chance that the cultural importance of the area would be degraded by more foot and
15 motorized traffic. As consultation with the Tribes continues and project-specific analyses are
16 undertaken, it is possible that there will be Native American concerns expressed over potential
17 visual effects of solar energy development within the SEZ on the landscape.

18
19 Localized effects could occur both within the proposed SEZ and in adjacent areas. Within
20 the SEZ these effects would include destruction or degradation of important plant resources,
21 destruction of the habitat of and interference with the movement of culturally important animal
22 species, destruction of archaeological sites and burials, and the degradation or destruction of
23 trails. Plant resources (e.g., creosotebush and saguaro cactus) are known to exist within the SEZ.
24 Any ground-disturbing activity associated with development within the SEZ has the potential
25 for destroying localized resources. However, significant tracts of Sonora–Mojave Creosotebush-
26 White Bursage Desert Scrub and Sonoran–Paloverde Mixed Cacti Desert Scrub would remain
27 outside the SEZ, and anticipated overall effects on these plant populations would be small.
28 While the construction of utility-scale solar energy facilities would reduce the amount of habitat
29 available to many animal species important to Native Americans, similar habitat is abundant and
30 the effect on animal populations is likewise likely to be small.

31
32 Since solar energy facilities cover large tracts of ground, even taking into account the
33 implementation of programmatic design features, it is unlikely that avoidance of all resources
34 would be possible. Programmatic design features (see Appendix A, Section A.2.2) assume that
35 the necessary cultural surveys, site evaluations, and Tribal consultations will occur.
36 Implementation of programmatic design features, as discussed in Appendix A, Section A.2.2,
37 should eliminate impacts on Tribes’ reserved water rights and the potential for groundwater
38 contamination issues.

39 40 **8.1.18.3 SEZ-Specific Design Features and Design Feature Effectiveness**

41
42
43 Programmatic design features to address impacts of potential concern to Native
44 Americans, such as avoidance of sacred sites, water sources, and tribally important plant and
45 animal species, are provided in Appendix A, Section A.2.2.

1 The need for and nature of SEZ-specific design features regarding potential issues of
2 concern would be determined during government-to-government consultation with affected
3 Tribes listed in Table 8.1.18-1. For example, the Quechan Tribe has requested that they be
4 consulted at the inception of any solar energy project that would affect resources important to
5 them. The Quechan also suggest that the clustering of large solar energy facilities be avoided;
6 that priority for development be given to lands already disturbed by agricultural or military use;
7 and that the feasibility of placing solar collectors on existing structures be considered, thus
8 minimizing or avoiding the use of undisturbed land (Jackson 2009).

9
10 Mitigation of impacts on archaeological sites and traditional cultural properties is
11 discussed in Section 8.1.17.3, in addition to design features discussed for historic properties in
12 Section A.2.2 of Appendix A.

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1 **8.1.19 Socioeconomics**

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3
4 **8.1.19.1 Affected Environment**

5
6 This section describes current socioeconomic conditions and local community services
7 within the region of influence (ROI) surrounding the proposed Brenda SEZ. The ROI is a three-
8 county area composed of La Paz County and Yuma County in Arizona, and Riverside County in
9 California. It encompasses the area in which workers are expected to spend most of their salaries
10 and in which a portion of site purchases and non-payroll expenditures from the construction,
11 operation, and decommissioning phases of the proposed SEZ facility are expected to take place.
12

13
14 **8.1.19.1.1 ROI Employment**

15
16 In 2008, employment in the ROI stood at 846,901 (Table 8.1.19.1-1). Over the period
17 1999 to 2008, the annual average employment growth rate was higher in Yuma County (3.6%)
18 than in Riverside County (2.5%), and La Paz County (0.6%). At 1.8%, the growth rate in the
19 ROI as a whole was lower than that for Arizona (2.3%), but higher than the average rate for
20 California (0.9%).
21

22 In the ROI in 2006, the services sector provided the highest percentage of employment at
23 44.3%, followed by wholesale and retail trade at 20.5% (Table 8.1.19.1-2). Smaller employment
24 shares were held by construction (13.4%) and manufacturing (9.7%). Within the three counties in
25 the ROI, the distribution of employment across sectors is similar to that of the ROI as a whole,
26
27

TABLE 8.1.19.1-1 ROI Employment in the Proposed Brenda SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
La Paz County, Arizona	6,621	7,023	0.6
Yuma County, Arizona	48,903	69,683	3.6
Riverside County, California	653,552	839,878	2.5
ROI	709,076	846,901	1.8
Arizona	2,355,357	2,960,199	2.3
California	15,566,900	17,059,574	0.9

28 Sources: U.S. Department of Labor (2009a,b).

TABLE 8.1.19.1-2 ROI Employment in the Proposed Brenda SEZ by Sector, 2006

Industry	La Paz County		Yuma County		Riverside County		ROI	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture ^a	493	11.4	5,017	10.3	17,064	3.0	22,574	3.6
Mining	60	1.4	53	0.1	505	0.1	618	0.1
Construction	136	3.1	4,696	9.6	78,556	13.8	83,388	13.4
Manufacturing	381	8.8	3,374	6.9	56,582	9.9	60,337	9.7
Transportation and public utilities	83	1.9	1,471	3.0	21,835	3.8	23,389	3.8
Wholesale and retail trade	1,114	25.7	10,624	21.8	116,343	20.4	128,081	20.5
Finance, insurance, and real estate	120	2.8	1,874	3.8	26,964	4.7	28,958	4.6
Services	1,990	46.0	21,636	44.4	252,847	44.3	276,473	44.3
Other	10	0.2	10	0.0	89	0.0	109	0.0
Total	4,329		48,746		570,468		623,543	

^a Agricultural employment includes 2007 data for hired farmworkers.

Sources: U.S. Bureau of the Census (2009a); USDA (2009a,b).

1 but employment in agriculture in La Paz County (11.4%) and Yuma County (10.3%) was higher
 2 than in the ROI as a whole, with lower employment shares in construction and manufacturing.
 3
 4

5 **8.1.19.1.2 ROI Unemployment**
 6

7 Unemployment rates have been significantly different in the three counties in the ROI.
 8 Over the period 1999 to 2008, the average rate in Yuma County (17.4%) was much higher than
 9 those in La Paz County (6.7%) and Riverside County (6.0%) (Table 8.1.19.1-3). The average rate
 10 in the ROI over this period was 7.0%, higher than the average rates for California (5.8%) and
 11 Arizona (4.8%). Unemployment rates for the first 10 months of 2009 contrast with rates for 2008
 12 as a whole; in Yuma County, the unemployment rate increased to 21.3%, while in Riverside
 13 County it reached 13.8%, and in La Paz County it reached 9.1%. The average rates for the ROI
 14 (14.4%) and for California (11.6%) and Arizona (8.4%) as a whole were also higher during this
 15 period than the corresponding average rates for 2008.
 16
 17

18 **8.1.19.1.3 ROI Urban Population**
 19

20 The population of the ROI in 2008 was almost 68% urban, with the majority of urban
 21 areas located in the California portion of the ROI, in Riverside County. In La Paz County, there
 22 are two small cities, Quartzite (3,468), and Parker (3,116), where population growth between
 23 2000 and 2008 has been relatively low or declining slightly, 0.4% in Parker and -0.1% in
 24 Quartzite. In Yuma County, there are three small cities in addition to Yuma (89,842): San Luis
 25 (24,654), Somerton (12,146), and Wellton (1,921). Population growth between 2000 and 2008
 26 has been relatively high in Somerton (6.6%) and San Luis (6.1%), with annual growth rates of
 27 1.9% in Yuma and 0.6% in Wellton.
 28
 29

**TABLE 8.1.19.1-3 ROI Unemployment Rates (%)
 for the Proposed Brenda SEZ**

Location	1999–2008	2008	2009 ^a
La Paz County, Arizona	6.7	7.4	9.1
Yuma County, Arizona	17.4	17.1	21.3
Riverside County, California	6.0	8.6	13.8
ROI	7.0	9.3	14.4
Arizona	4.8	5.5	8.4
California	5.8	7.2	11.6

^a Rates for 2009 are the average for January through November.

Sources: U.S. Department of Labor (2009a–c).

1 In the California portion of the ROI, the largest urban area, Riverside, had an estimated
 2 2008 population of 293,225; other large cities in the western portion of the county include
 3 Moreno Valley (188,688) and Corona (148,346) (Table 8.1.19.1-4). In addition, there are eight
 4 cities in the county with a 2008 population between 50,000 and 99,999 persons. The majority of
 5 these cities are part of the larger urban region that includes Los Angeles, Riverside, and San
 6 Bernardino, and most are more than 150 mi (241 km) from the site of the proposed SEZ.
 7
 8

TABLE 8.1.19.1-4 ROI Urban Population and Income for the Proposed Brenda SEZ

City	Population			Median Household Income (\$ 2008)		
	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	1999	2006–2008	Average Annual Growth Rate, 1999 and 2006–2008 ^a (%)
Riverside	255,166	293,225	1.8	53,620	56,805	0.6
Moreno Valley	142,381	188,688	3.6	61,101	55,178	-1.1
Corona	124,966	143,346	2.2	76,755	78,120	0.2
Murietta	44,282	97,935	10.4	78,424	79,135	0.1
Temecula	57,716	95,859	6.5	76,628	77,394	0.1
Yuma	77,715	89,842	1.9	45,545	42,095	-0.9
Indio	49,116	83,480	6.9	44,579	53,824	2.1
Hemet	58,812	70,826	2.4	34,556	34,974	0.1
Perris	36,189	55,117	5.4	45,774	53,442	1.7
Cathedral City	42,647	51,793	2.5	50,068	42,026	-1.9
Lake Elsinore	28,928	50,494	7.1	53,926	58,496	0.9
Palm Desert	41,155	50,232	2.6	62,208	55,218	-1.3
La Quinta	23,694	43,232	7.8	70,237	78,898	1.3
Coachella	22,724	39,004	7.0	36,810	40,463	1.1
San Jacinto	23,779	37,477	5.9	39,433	47,127	2.0
Norco	24,157	26,456	1.1	80,537	78,141	-0.3
San Luis	15,322	24,654	6.1	29,569	23,305	-2.6
Desert Hot Springs	16,582	23,995	4.7	33,459	38,465	1.6
Blythe	12,155	21,650	7.5	45,480	37,937	-2.0
Rancho Mirage	13,249	16,582	2.8	77,027	NA ^b	NA
Somerton	7,266	12,146	6.6	34,176	NA	NA
Canyon Lake	9,952	11,064	1.3	90,263	NA	NA
Calimesa	7,139	7,479	0.6	48,731	NA	NA
Indian Wells	3,816	5,114	3.7	121,008	NA	NA
Quartzite	3,354	3,468	0.4	29,681	NA	NA
Parker	3,140	3,116	-0.1	44,580	NA	NA
Wellton	1,829	1,921	0.6	34,821	NA	NA

^a Data are averages for the period 2006–2008.

^b NA = data not available.

Source: U.S. Bureau of the Census (2009b,d).

1 Population growth rates among the larger cities in the western part of the county have
2 varied over the period 2000 to 2008. Murietta grew at an annual rate of 10.4% during this period;
3 higher-than-average growth was also experienced in Lake Elsinore (7.1%), Temecula (6.5%),
4 and San Jacinto (5.9%). The cities of Hemet (2.4%), Corona (2.2%), and Riverside (1.8%) all
5 experienced lower growth rates between 2000 and 2008.

6
7 A smaller group of cities, including Indio (83,480), Cathedral City (51,793), Palm Desert
8 (50,494), Coachella (39,004), La Quinta (43,232), and Desert Hot Springs (23,995), is about
9 100 mi (161 km) from the SEZ site. Population growth in these cities between 2000 and 2008
10 has been relatively high, with annual growth rates of 7.8% in La Quinta, Coachella (7.0%),
11 Indio (6.9%), and Desert Hot Springs (4.7%). One city, Blythe (21,650), is located
12 on the eastern border of the county, on the Colorado River, less than 10 mi (16 km) from the
13 proposed SEZ location, and had a relatively high population growth rate (7.5%) between 2000
14 and 2008.

15 16 17 **8.1.19.1.4 ROI Urban Income**

18
19 Median household incomes varied considerably across cities in the ROI. In each city in
20 Yuma County and La Paz County, median household incomes in 1999 were lower than the
21 average for the state (\$57,399) (Table 8.1.19.1-4). Of these cities, Yuma (\$45,545) had the
22 largest median household income, followed by Parker (\$44,580). Quartzite (\$29,681) and
23 San Luis (\$29,569) had median household incomes that were close to half the state average.

24
25 Data on median household incomes for the period 2006 to 2008 were only available for
26 two cities in the Arizona portion of the ROI. Median income growth rates for the period 1999
27 and 2006 to 2008 were negative in Yuma (-0.9%), with a fairly large decline in median incomes
28 in San Luis (-2.6%). The average median household income growth rate for the state as a whole
29 over this period was -0.2%.

30
31 A number of cities in the western part of Riverside County—Murietta (\$79,135), Corona
32 (\$78,141), and Temecula (\$77,394)—had median household incomes in 2006 to 2008 that were
33 higher than the average for the state (\$61,154) (Table 8.1.19.1-4). A number of cities in the
34 western portion of the county had relatively low median household incomes, notably Hemet
35 (\$34,974) and San Jacinto (\$47,127).

36
37 Among the cities in the western part of Riverside County, median household income
38 growth rates between 1999 and 2006 to 2008 were highest in San Jacinto (2.1%) and Perris
39 (1.7%), with lower annual growth rates elsewhere. Moreno Valley (-1.1%) and Norco (-0.3%)
40 had negative median household income growth rates between 1999 and 2006 to 2008. The
41 average median household income growth rate for the state as a whole over this period was less
42 than 0.1%.

43
44 Elsewhere in the county, La Quinta (\$78,898) had a median household income higher
45 than the state average between 2006 and 2008, while other cities—Palm Desert (\$55,218), Indio
46 (\$53,824), Cathedral City (\$42,026), Coachella (\$40,463), and Desert Hot Springs (\$38,465)—

1 had median household incomes less than the state average. The median income in Blythe in 2006
 2 to 2008 was \$37,937. Growth rates in these cities over the period 1999 and 2006 to 2008 varied
 3 from 2.1% in Indio to -2.0% in Blythe.

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6 **8.1.19.1.5 ROI Population**
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8 Table 8.2.19.1-5 presents recent and projected populations in the ROI and each state as a
 9 whole. Population in the ROI stood at 2,301,221 in 2008, having grown at an average annual
 10 rate of 3.7% since 2000. Growth rates for the ROI were higher than those for both Arizona
 11 (3.0%) and California (1.0%) over the same period.

12
13 Each county in the ROI experienced growth in population between 2000 and 2008;
 14 population in Riverside County grew at an annual rate of 3.8%; in Yuma County population
 15 grew by 2.4%, with lower rates in La Paz County (0.2%). The ROI population is expected to
 16 increase to 3,267,002 by 2021 and to 3,397,476 by 2023.

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18
19 **8.1.19.1.6 ROI Income**
20

21 Total personal income in the ROI stood at \$68.1 billion in 2007 and has grown at an
 22 annual average rate of 4.0% over the period 1998 to 2007 (Table 8.1.19.1-6). Per-capita income
 23 also rose over the same period at a rate of 0.6%, increasing from \$28,174 to \$29,910. Per-capita
 24 incomes were higher in Riverside County (\$30,713) than La Paz County (\$25,124) and Yuma
 25 County (\$22,194) in 2007. Growth rates in total personal income have been slightly higher in
 26
27

TABLE 8.1.19.1-5 ROI Population for the Proposed Brenda SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
La Paz County, Arizona	19,715	20,005	0.2	25,757	26,302
Yuma County, Arizona	160,026	193,299	2.4	276,132	285,531
Riverside County, California	1,545,387	2,087,917	3.8	2,965,113	3,085,643
ROI	1,725,128	2,301,221	3.7	3,267,002	3,397,476
Arizona	5,130,632	6,499,377	3.0	8,945,447	9,271,163
California	33,871,648	36,580,371	1.0	44,646,420	45,667,413

Sources: U.S. Bureau of the Census (2009e,f); Arizona Department of Commerce (2010); California Department of Finance (2010).

TABLE 8.1.19.1-6 ROI Personal Income for the Proposed Brenda SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
La Paz County, Arizona			
Total income ^a	0.4	0.5	3.3
Per-capita income	19,345	25,124	2.6
Yuma County, Arizona			
Total income ^a	3.3	4.5	3.0
Per-capita income	22,314	22,194	-0.1
Riverside County, California			
Total income ^a	42.2	63.1	4.1
Per-capita income	28,886	30,713	0.6
ROI			
Total income ^a	45.9	68.1	4.0
Per-capita income	28,174	29,910	0.6
Arizona			
Total income ^a	149.2	215.8	3.8
Per-capita income	30,551	33,558	0.9
California			
Total income ^a	1,231.7	1,573.6	2.5
Per-capita income	37,339	41,821	1.1

^a Unless indicated otherwise, values are reported in \$ billion 2008.

Sources: U.S. Department of Commerce (2009); U.S. Bureau of the Census (2009e,f).

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Riverside County, with higher growth rates in per-capita income in La Paz County. Personal income growth rates in the ROI were higher than the rate for Arizona (3.8%) and California (2.5%), but per-capita income growth rates in the ROI were slightly lower those in California (1.1%) and Arizona (0.9%) as a whole.

Median household income over the period 2006 to 2008 varied from \$58,168 in Riverside County, to \$40,079 in Yuma County and \$30,797 in La Paz County (U.S. Bureau of the Census 2009d).

1 **8.1.19.1.7 ROI Housing**
2

3 In 2007, 856,660 housing units were located in the three ROI counties, with about
4 88% of these located in Riverside County (Table 8.1.19.1-7). Owner-occupied units compose
5 approximately 69% of the occupied units in the three counties, with rental housing making up
6 31% of the total. Vacancy rates in 2007 were 38.5% in La Paz County, 19.8% in Yuma County,
7 and 14.2% in Riverside County; 8.2% of housing units in the ROI were used for seasonal or
8 recreational purposes in 2000. With an overall vacancy rate of 15.2% in the ROI, there were
9 130,551 vacant housing units in the ROI in 2007, of which 40,222 are estimated to be rental
10 units that would be available to construction workers. There were 55,110 units in seasonal,
11 recreational, or occasional use at the time of the 2000 Census.
12

13 Housing stock in the ROI as a whole grew at an annual rate of 3.5% over the period 2000
14 to 2007, with 182,713 new units added to the existing housing stock (Table 8.1.19.1-6).
15

16 The median value of owner-occupied housing in 2006 to 2008 varied between \$95,300 in
17 La Paz County, \$147,400 in Yuma County, and \$380,600 in Riverside County (U.S. Bureau of
18 the Census 2009g).
19
20

21 **8.1.19.1.8 ROI Local Government Organizations**
22

23 The various local and county government organizations in the ROI are listed in
24 Table 8.1.19.1-8. In addition, there are 15 Tribal governments located in the county, with
25 members of other Tribal groups located in the area, but whose Tribal governments are located
26 in adjacent counties or states.
27
28

29 **8.1.19.1.9 ROI Community and Social Services**
30

31 This section describes educational, health care, law enforcement, and firefighting
32 resources in the ROI.
33
34

35 **Schools**
36

37 In 2007, the three-county ROI had a total of 544 public and private elementary, middle,
38 and high schools (NCES 2009). Table 8.1.19.1-9 provides summary statistics for enrollment and
39 educational staffing and two indices of educational quality—student-teacher ratios and levels of
40 service (number of teachers per 1,000 population). The student-teacher ratio in Riverside County
41 schools (22.1) is slightly higher than that in Yuma County schools (20.2), and in La Paz County
42 (16.2), and the level of service is slightly higher in Riverside County (9.3) than in Yuma County
43 (8.9) and La Paz County (8.0), where there are fewer teachers per 1,000 population.
44
45

TABLE 8.1.19.1-7 ROI Housing Characteristics for the Proposed Brenda SEZ

Parameter	2000	2007 ^a
La Paz County, Arizona		
Owner-occupied	6,521	7,312
Rental	1,841	2,322
Vacant units	6,771	6,029
Seasonal and recreational use	5,234	NA ^b
Total units	15,133	15,663
Yuma County, Arizona		
Owner-occupied	38,911	48,658
Rental	14,937	20,774
Vacant units	20,292	17,150
Seasonal and recreational use	11,668	NA
Total units	74,140	86,582
Riverside County, California		
Owner-occupied	348,532	446,017
Rental	157,686	201,426
Vacant units	78,456	106,972
Seasonal and recreational use	38,208	NA
Total units	584,674	754,415
ROI		
Owner-occupied	393,964	501,987
Rental	174,464	224,522
Vacant units	105,519	130,551
Seasonal and recreational use	55,110	NA
Total units	673,947	856,660

^a 2007 data for number of owner-occupied, rental, and vacant units for California counties are not available; data are based on 2007 total housing units and 2000 data on housing tenure.

^b NA = data not available.

Sources: U.S. Bureau of the Census (2009dh-j).

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Health Care

The total number of physicians (3,277) is much higher in Riverside County than elsewhere in the ROI, but the number of physicians per 1,000 population in Riverside County (1.6) is only slightly higher than in Yuma County (1.4), which is still higher than in La Paz County (1.0) (Table 8.1.19.1-10).

TABLE 8.1.19.1-8 ROI Local Government Organizations and Social Institutions in the Proposed Brenda SEZ ROI

Governments

City

Apache Junction	Perris
Parker	Cathedral City
Quartzite	Lake Elsinore
San Luis	Palm Desert
Somerton	La Quinta
Wellton	Coachella
Westmoreland	San Jacinto
Yuma	Norco
Riverside	Desert Hot Springs
Moreno Valley	Blythe
Corona	Rancho Mirage
Murietta	Canyon Lake
Temecula	Calimesa
Indio	Indian Wells
Hemet	

County

La Paz County, Arizona	Riverside County, California
Yuma County, Arizona	

Tribal

- Agua Caliente Band of Cahuilla Indians of the Agua Caliente Indian Reservation, California
- Augustine Band of Cahuilla Mission Indians of the Augustine Reservation, California
- Cabazon Band of Mission Indians, California
- Cahuilla Band of Mission Indians of the Cahuilla Reservation, California
- Colorado River Indian Tribes of the Colorado River Indian Reservation, Arizona and California
- Fort McDowell Yavapai Nation, Arizona
- Ione Band of Miwok Indians of California
- Cocopah Tribe of Arizona
- Morongo Band of Cahuilla Mission Indians of the Morongo Reservation, California
- Pechanga Band of Luiseno Mission Indians of the Pechanga Reservation, California
- Quechan Tribe of the Fort Yuma Indian Reservation, California and Arizona
- Ramona Band or Village of Cahuilla Mission Indians of California
- Santa Rosa Band of Cahuilla Indians, California
- Soboba Band of Luiseno Indians, California
- Torres Martinez Desert Cahuilla Indians, California

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

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TABLE 8.1.19.1-9 ROI School District Data for the Proposed Brenda SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service ^a
La Paz County, Arizona	2,591	160	16.2	8.0
Yuma County, Arizona	36,287	1,800	20.2	8.9
Riverside County, California	421,642	19,105	22.1	9.3
ROI	460,520	21,065	21.9	9.3

^a Number of teachers per 1,000 population.

Source: NCES (2009).

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TABLE 8.1.19.1-10 Physicians in the Proposed Brenda SEZ ROI, 2007

Location	Number of Primary Care Physicians	Level of Service ^a
La Paz County, Arizona	20	1.0
Yuma County, Arizona	268	1.4
Riverside County, California	3,277	1.6
ROI	3,565	1.6

^a Number of physicians per 1,000 population.

Source: AMA (2009).

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Public Safety

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Several state, county, and local police departments provide law enforcement in the ROI (Table 8.1.19.1-11). La Paz County has 36 officers who would provide law enforcement services to the SEZ; there are 68 officers in Yuma County and 1,965 officers in Riverside County. Levels of service of police protection are 1.8 officers per 1,000 population in La Paz County, 1.0 in Riverside County, and 0.4 in Yuma County. Currently, there are 2,346 professional firefighters in the ROI (Table 8.1.19.1-11).

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8.1.19.1.10 ROI Social Structure and Social Change

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14

Community social structures and other forms of social organization within the ROI are related to various factors, including historical development, major economic activities and sources of employment, income levels, race and ethnicity, and forms of local political

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TABLE 8.1.19.1-11 Public Safety Employment in the Proposed Brenda SEZ ROI

Location	Number of Police Officers ^a	Level of Service ^b	Number of Firefighters ^c	Level of Service ^b
La Paz County, Arizona	36	1.8	14	0.7
Yuma County, Arizona	68	0.4	127	0.7
Riverside County, California	1,965	1.0	2,205	1.1
ROI	2,001	0.9	2,346	1.0

^a 2007 data.

^b Number per 1,000 population.

^c 2008 data; number does not include volunteers.

Sources: U.S. Department of Justice (2008); Fire Departments Network (2009).

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organization. Although an analysis of the character of community social structures is beyond the scope of the current programmatic analysis, project-level NEPA analyses would include a description of ROI social structures, contributing factors, their uniqueness, and, consequently, the susceptibility of local communities to various forms of social disruption and social change.

Various energy development studies have suggested that once the annual growth in population is between 5 and 15% in smaller rural communities, alcoholism, depression, suicide, social conflict, divorce, and delinquency would increase and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Data on violent crime and property crime rates and on alcoholism and illicit drug use, mental health, and divorce, which might be used as indicators of social change, are presented in Tables 8.1.19.1-12 and 8.1.19.1-13, respectively.

There is some variation in the level of crime across the ROI, with higher rates of violent crime in La Paz County (11.3 per 1,000 population) than in Riverside County (3.5), and Yuma County (3.1) (Table 8.1.19.1-12).

Property-related crime rates are also higher in La Paz County (105.5) than in Riverside County (27.5) and Yuma County (21.1); that is, overall crime rates in La Paz County (116.8) were higher than in Riverside County (31.0), and Yuma County (24.2).

Data on other measures of social change—alcoholism, illicit drug use, and mental health—are not available at the county level and thus are presented for the SAMHSA region in which the ROI is located. There is some variation across the two regions in which the three counties are located; rates for alcoholism and illicit drug are slightly higher in the region in which Riverside County is located and rates of mental illness are slightly higher in the region in which La Paz County and Yuma County are located (Table 8.1.19.1-13).

TABLE 8.1.19.1-12 County and ROI Crime Rates for the Proposed Brenda SEZ^a

	Violent Crime ^b		Property Crime ^c		All Crime	
	Offenses	Rate	Offenses	Rate	Offenses	Rate
La Paz County, Arizona	226	11.3	2,111	105.5	2,337	116.8
Yuma County, Arizona	637	3.1	4,376	21.1	5,013	24.2
Riverside County, California	7,351	3.5	57,839	27.5	65,190	31.0
ROI	8,214	3.6	64,326	28.0	72,540	31.5

^a Rates are the number of crimes per 1,000 population; data are for 2008.

^b Violent crime includes murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault.

^c Property crime includes burglary, larceny, theft, motor vehicle theft, and arson.

Sources: U.S. Department of Justice (2009a,b).

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TABLE 8.1.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Brenda SEZ ROI^a

Geographic Area	Alcoholism	Illicit Drug Use	Mental Health ^b	Divorce ^c
Arizona Rural South Region (includes Yuma County)	7.3	2.6	8.8	NA ^d
California Region 13 (includes Riverside County)	8.5	3.2	8.6	NA
Arizona				3.9
California				4.3

^a Data for alcoholism and drug use represent percentage of the population over 12 years of age with dependence or abuse of alcohol, illicit drugs. Data are averages for 2004 to 2006.

^b Data for mental health represent percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

^c Divorce rates are the number of divorces per 1,000 population. Arizona data are for 2007; California data are for 1990.

^d NA = not applicable.

Sources: SAMHSA (2009); CDC (2009).

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1 **8.1.19.1.11 ROI Recreation**

2
3 There are various areas in the vicinity of the proposed SEZ that are used for recreational
4 purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for a
5 range of activities, including hunting, fishing, boating, canoeing, wildlife watching, camping,
6 hiking, horseback riding, mountain climbing, and sightseeing. These areas are discussed in
7 Section 7.2.5.

8
9 Because the number of visitors using state and federal lands for recreational activities
10 is not available from the various administering agencies, the value of recreational resources in
11 these areas, based solely on the number of recorded visitors, is likely to be an underestimation.
12 In addition to visitation rates, the economic valuation of certain natural resources can also be
13 assessed in terms of the potential recreational destination for current and future users, that is,
14 their nonmarket value (see Appendix M).

15
16 Another method is to estimate the economic impact of the various recreational activities
17 supported by natural resources on public land in the vicinity of the proposed solar development,
18 by identifying sectors in the economy in which expenditures on recreational activities occur. Not
19 all activities in these sectors are directly related to recreation on state and federal lands, with
20 some activity occurring on private land (e.g., dude ranches, golf courses, bowling alleys, and
21 movie theaters). Expenditures associated with recreational activities form an important part of
22 the economy of the ROI. In 2007, 82,375 people were employed in the ROI in the various
23 sectors identified as recreation, constituting 9.5% of total ROI employment (Table 8.1.19.1-14).
24 Recreation spending also produced almost \$2,479 million in income in the ROI in 2007. The
25 primary sources of recreation-related employment were eating and drinking places.

26
27
28 **8.1.19.2 Impacts**

29
30 The following analysis begins with a description of the common impacts of solar
31 development, including common impacts on recreation and on social change. These impacts
32 would occur regardless of the solar technology developed in the SEZ. The impacts of
33 developments employing various solar energy technologies are analyzed in detail in subsequent
34 sections.

35
36
37 **8.1.19.2.1 Common Impacts**

38
39 Construction and operation of a solar energy facility at the proposed Brenda SEZ
40 would produce direct and indirect economic impacts. Direct impacts would occur as a result of
41 expenditures on wages and salaries, procurement of goods and services required for project
42 construction and operation, and the collection of state sales and income taxes. Indirect impacts
43 would occur as project wages and salaries, procurement expenditures, and tax revenues
44 subsequently circulated through the economy of each state, thereby creating additional
45 employment, income, and tax revenues. Facility construction and operation would also require
46 in-migration of workers and their families into the ROI surrounding the site, which would
47 affect population, rental housing, health service employment, and public safety employment.

TABLE 8.1.19.1-14 Recreation Sector Activity in the Proposed Brenda SEZ ROI, 2007

ROI	Employment	Income (\$ million)
Amusement and recreation services	5,385	174.5
Automotive rental	693	38.0
Eating and drinking places	60,063	1,214.1
Hotels and lodging places	8,956	309.2
Museums and historic sites	304	21.1
Recreational vehicle parks and campsites	934	26.0
Scenic tours	1,936	124.2
Sporting goods retailers	4,104	571.3
Total ROI	82,375	2,478.5

Source: MIG, Inc. (2010).

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Socioeconomic impacts common to all utility-scale solar energy developments are discussed in detail in Section 5.17. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2.

Recreation Impacts

Estimating the impact of solar facilities on recreation is problematic because it is not clear how solar development in the SEZ would affect recreational visitation and nonmarket values (i.e., the value of recreational resources for potential or future visits; see Appendix M). While it is clear that some land in the ROI would no longer be accessible for recreation, the majority of popular recreational locations would be precluded from solar development. It is also possible that solar development in the ROI would be visible from popular recreation locations, and that construction workers residing temporarily in the ROI would occupy accommodation otherwise used for recreational visits, thus reducing recreational visitation and consequently affecting the economy of the ROI.

Social Change

Although an extensive literature in sociology documents the most significant components of social change in energy boomtowns, the nature and magnitude of the social impact of energy developments in small rural communities are still unclear (see Section 5.17.1.1.4). While some degree of social disruption is likely to accompany large-scale in-migration during the boom phase, there is insufficient evidence to predict the extent to which specific communities are likely to be impacted, which population groups within each community are likely to be most affected, and the extent to which social disruption is likely to persist beyond the end of the boom

1 period (Smith et al. 2001). Accordingly, because of the lack of adequate social baseline data, it
2 has been suggested that social disruption is likely to occur once an arbitrary population growth
3 rate associated with solar energy development projects has been reached, with an annual rate of
4 between 5 and 10% growth in population assumed to result in a breakdown in social structures,
5 with a consequent increase in alcoholism, depression, suicide, social conflict, divorce, and
6 delinquency, and deterioration in levels of community satisfaction (BLM 1980, 1983, 1996).

7
8 In overall terms, the in-migration of workers and their families into the ROI would
9 represent an increase of less than 0.1% in ROI population during construction of the trough
10 technology, with smaller increases for the power tower, dish engine and PV technologies, and
11 during the operation of each technology. While it is possible that some construction and
12 operations workers will choose to locate in communities closer to the SEZ, the lack of available
13 housing in smaller rural communities in the ROI to accommodate all in-migrating workers and
14 families, and insufficient range of housing choices to suit all solar occupations, make it likely
15 that many workers will commute to the SEZ from larger communities elsewhere in the ROI,
16 reducing the potential impact of solar developments on social change. Regardless of the pace of
17 population growth associated with the commercial development of solar resources, and the likely
18 residential location of in-migrating workers and families in communities some distance from the
19 SEZ itself, the number of new residents from outside the region of influence is likely to lead to
20 some demographic and social change in small rural communities in the ROI. Communities
21 hosting solar developments are likely to be required to adapt to a different quality of life, with a
22 transition away from a more traditional lifestyle involving ranching and taking place in small,
23 isolated, close-knit, homogenous communities with a strong orientation toward personal and
24 family relationships, toward a more urban lifestyle, with increasing cultural and ethnic diversity
25 and increasing dependence on formal social relationships within the community.

26 27 28 **Livestock Grazing Impacts**

29
30 Cattle ranching and farming supported 628 jobs and \$7.4 million in income in the ROI in
31 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the Brenda SEZ
32 could result in a decline in the amount of land available for livestock grazing. However, because
33 the amount of acreage that would be used in the proposed SEZ would be small compared with
34 the overall size of local land allotments, acreage loss would not have a significant impact on
35 overall grazing operations. Livestock management changes, or the provision of additional
36 livestock management facilities, would mean that no loss of AUMs is anticipated.

37 38 39 **Transmission Line Impacts**

40
41 The impacts of transmission line construction could include the addition of 98 jobs in the
42 ROI (including direct and indirect impacts) in the peak year of construction (Table 8.1.19.2-1).
43 Construction activities in the peak year would constitute less than 1% of total ROI employment.
44 A transmission line would also produce \$5.1 million in ROI income. Direct sales taxes and direct
45 income taxes would be \$0.1 million.

TABLE 8.1.19.2-1 ROI Socioeconomic Impacts of a 230-kV Transmission Line at the Proposed Brenda SEZ^a

Parameter	Construction	Operations
Employment (no.)		
Direct	39	<1
Total	98	1
Income ^b		
Total	5.1	<0.1
Direct state taxes ^b		
Sales	0.1	<0.1
Income	0.1	<0.1
In-migrants (no.)	31	0
Vacant housing ^c (no.)	16	0
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts assume 19 mi (31 km) of transmission line are required for the Brenda SEZ. Construction impacts are assessed for the peak year of construction.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

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Given the likelihood of local worker availability in the required occupational categories, construction of a transmission line would mean that some in-migration of workers and their families from outside the ROI would be required, with 37 persons in-migrating into the ROI during the peak construction year. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 19 rental units expected to be occupied in the ROI. This occupancy rate would represent less than 1% of the vacant rental units expected to be available in the ROI in the peak year.

No new community service employment would be required in order to meet existing levels of service in the three ROIs.

1 Total operations employment impacts in the ROI (including direct and indirect impacts)
2 of a transmission line would be 1 job during the first year of operation (Table 8.1.19.2-1)
3 and would produce less than \$0.1 million in income. Direct sales taxes would be less than
4 \$0.1 million in the first year, with direct income taxes of less than \$0.1 million. Operation of a
5 transmission line would not require the in-migration of workers and their families from outside
6 the ROI; consequently, no impacts on housing markets in the ROI would be expected, and no
7 new community service employment would be required in order to meet existing levels of
8 service in the ROI.

9 10 11 **8.1.19.2.2 Technology-Specific Impacts** 12

13 The economic impacts of solar energy development in the proposed SEZ were measured
14 in terms of employment, income, state tax revenues (sales and income), population in-migration,
15 housing, and community service employment (education, health, and public safety). More
16 information on the data and methods used in the analysis can be found in Appendix M.
17

18 The assessment of the impact of the construction and operation of each technology was
19 based on SEZ acreage, assuming 80% of the area could be developed. To capture a range of
20 possible impacts, solar facility size was estimated on the basis of the land requirements of
21 various solar technologies, assuming that 9 acres/MW (0.04 km²/MW) would be required for
22 power tower, dish engine, and PV technologies and 5 acres/MW (0.02 km²/MW) would be
23 required for solar trough technologies. Impacts of multiple facilities employing a given
24 technology at each SEZ were assumed to be the same as impacts for a single facility with the
25 same total capacity. Construction impacts were assessed for a representative peak year of
26 construction, assumed to be 2021 for each technology. Construction impacts assumed that a
27 maximum of one project could be constructed within a given year, with a corresponding
28 maximum land disturbance of up to 3,000 acres (12 km²). For operations impacts, a
29 representative first year of operations was assumed to be 2023 for trough and power tower
30 and 2022 for the minimum facility size for dish engine and PV, and 2023 was assumed for
31 the maximum facility size for these technologies. The years of construction and operations
32 were selected as representative of the entire 20-year study period because they are the
33 approximate midpoint; construction and operations could begin earlier.
34

35 36 **Solar Trough** 37 38

39 **Construction.** Total construction employment impacts in the ROI (including direct
40 and indirect impacts) from the use of solar trough technologies would be up to 5,245 jobs
41 (Table 8.1.19.2-2). Construction activities would constitute 0.4% of total ROI employment.
42 A solar facility would also produce \$309.0 million in income. Direct sales taxes would be
43 \$13.7 million, and direct income taxes, \$6.3 million.
44

45 Given the scale of construction activities and the likelihood of local worker availability
46 in the required occupational categories, construction of a solar facility would mean that some

1 in-migration of workers and their families from outside the ROI would be required, with
2 743 persons in-migrating into the ROI. Although in-migration may potentially affect local
3 housing markets, the relatively small number of in-migrants and the availability of temporary
4 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
5 construction on the number of vacant rental housing units would not be expected to be large,
6 with 371 rental units expected to be occupied in the ROI. This occupancy rate would represent
7 0.6% of the vacant rental units expected to be available in the ROI.
8

9 In addition to the potential impact on housing markets, in-migration would affect
10 community service employment (education, health, and public safety). An increase in such
11 employment would be required to meet existing levels of service in the ROI. Accordingly,
12 7 new teachers, 1 physician, and 1 public safety employee (career firefighters and uniformed
13 police officers) would be required in the ROI. These increases would represent less than 0.1%
14 of total ROI employment expected in these occupations.
15
16

17 **Operations.** Total operations employment impacts in the ROI (including direct
18 and indirect impacts) of a build-out using solar trough technologies would be 217 jobs
19 (Table 8.1.19.2-2). Such a solar facility would also produce \$8.1 million in income.
20 Direct sales taxes would be \$0.2 million, and direct income taxes, \$0.2 million. Based on fees
21 established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), acreage rental
22 payments would be \$0.2 million, and solar generating capacity payments would total at least
23 \$4.1 million.
24

25 Given the likelihood of local worker availability in the required occupational categories,
26 operation of a solar facility would mean that some in-migration of workers and their families
27 from outside the ROI would be required, with 17 persons in-migrating into the ROI. Although
28 in-migration may potentially affect local housing markets, the relatively small number of
29 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home
30 parks) mean that the impact of solar facility operation on the number of vacant owner-occupied
31 housing units would not be expected to be large, with 15 owner-occupied units expected to be
32 occupied in the ROI.
33

34 No new community service employment would be required to meet existing levels of
35 service in the ROI.
36
37

38 **Power Tower**

39
40

41 **Construction.** Total construction employment impacts in the ROI (including direct
42 and indirect impacts) from the use of power tower technologies would be up to 2,089 jobs
43 (Table 8.1.19.2-3). Construction activities would constitute 0.2% of total ROI employment.
44 Such a solar facility would also produce \$123.1 million in income. Direct sales taxes would
45 be less than \$5.5 million, with direct income taxes of \$2.5 million.
46

TABLE 8.1.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Brenda SEZ with Trough Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	1,744	131
Total	5,245	217
Income ^b		
Total	309.0	8.1
Direct state taxes ^b		
Sales	13.7	0.2
Income	6.3	0.2
BLM payments (\$ million 2008)		
Rental	NA ^c	0.2
Capacity ^d	NA	4.1
In-migrants (no.)	743	17
Vacant housing ^e (no.)	371	15
Local community service employment		
Teachers (no.)	7	0
Physicians (no.)	1	0
Public safety (no.)	1	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that one facility with a combined capacity of up to 600 MW (corresponding to 3,000 acres [12 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 620 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c NA = not applicable.

^d The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), assuming a solar facility with no storage capability and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

TABLE 8.1.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Brenda SEZ with Power Tower Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	695	68
Total	2,089	94
Income ^b		
Total	123.1	3.3
Direct state taxes ^b		
Sales	5.5	<0.1
Income	2.5	0.1
BLM payments (\$ million 2008)		
Rental	NA ^c	0.2
Capacity ^d	NA	2.3
In-migrants (no.)	296	9
Vacant housing ^e (no.)	148	8
Local community service employment		
Teachers (no.)	3	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that one facility with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c NA = not applicable.

^d The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1
2

1 Given the scale of construction activities and the likelihood of local worker availability
2 in the required occupational categories, construction of a solar facility would mean that some
3 in-migration of workers and their families from outside the ROI would be required, with
4 296 persons in-migrating into the ROI. Although in-migration may potentially affect local
5 housing markets, the relatively small number of in-migrants and the availability of temporary
6 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
7 construction on the number of vacant rental housing units would not be expected to be large,
8 with 148 rental units expected to be occupied in the ROI. This occupancy rate would represent
9 0.3% of the vacant rental units expected to be available in the ROI.

10
11 In addition to the potential impact on housing markets, in-migration would affect
12 community service (education, health, and public safety) employment. An increase in such
13 employment would be required to meet existing levels of service in the ROI. Accordingly,
14 3 new teachers would be required in the ROI. This increase would represent less than 0.1% of
15 total ROI employment expected in this occupation.

16
17
18 **Operations.** Total operations employment impacts in the ROI (including direct
19 and indirect impacts) of a build-out using power tower technologies would be 94 jobs
20 (Table 8.1.19.2-3). Such a solar facility would also produce \$3.3 million in income. Direct
21 sales taxes would be less than \$0.1 million, and direct income taxes, \$0.1 million. Based on fees
22 established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), acreage rental
23 payments would be \$0.2 million, and solar generating capacity payments would total at least
24 \$2.3 million.

25
26 Given the likelihood of local worker availability in the required occupational categories,
27 operation of a solar facility means that some in-migration of workers and their families from
28 outside the ROI would be required, with 9 persons in-migrating into the ROI. Although
29 in-migration may potentially affect local housing markets, the relatively small number of
30 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile
31 home parks) mean that the impact of solar facility operation on the number of vacant
32 owner-occupied housing units would not be expected to be large, with 8 owner-occupied
33 units expected to be required in the ROI.

34
35 No new community service employment would be required to meet existing levels of
36 service in the ROI.

37 38 39 **Dish Engine**

40
41
42 **Construction.** Total construction employment impacts in the ROI (including direct
43 and indirect impacts) from the use of dish engine technologies would be up to 849 jobs
44 (Table 8.1.19.2-4). Construction activities would constitute 0.1% of total ROI employment.
45 Such a solar facility would also produce \$50.1 million in income. Direct sales taxes would
46 be less than \$2.2 million, and direct income taxes, \$1.0 million.

TABLE 8.1.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Brenda SEZ with Dish Engine Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	282	66
Total	849	92
Income ^b		
Total	50.1	3.2
Direct state taxes ^b		
Sales	2.2	<0.1
Income	1.0	0.1
BLM payments (\$ million 2008)		
Rental	NA ^c	0.2
Capacity ^d	NA	2.3
In-migrants (no.)	120	8
Vacant housing ^e (no.)	60	8
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that one facility with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c NA = not applicable.

^d The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), assuming a solar facility with no storage capability and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1 Given the scale of construction activities and the likelihood of local worker availability
2 in the required occupational categories, construction of a solar facility would mean that some
3 in-migration of workers and their families from outside the ROI would be required, with
4 120 persons in-migrating into the ROI. Although in-migration may potentially affect local
5 housing markets, the relatively small number of in-migrants and the availability of temporary
6 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
7 construction on the number of vacant rental housing units would not be expected to be large,
8 with 60 rental units expected to be occupied in the ROI. This occupancy rate would represent
9 0.1% of the vacant rental units expected to be available in the ROI.

10
11 In addition to the potential impact on housing markets, in-migration would affect
12 community service (education, health, and public safety) employment. An increase in such
13 employment would be required to meet existing levels of service in the ROI. Accordingly, one
14 new teacher would be required in the ROI. This increase would represent less than 0.1% of total
15 ROI employment expected in this occupation.

16
17
18 **Operations.** Total operations employment impacts in the ROI (including direct
19 and indirect impacts) of a build-out using dish engine technologies would be 92 jobs
20 (Table 8.1.19.2-4). Such a solar facility would also produce less than \$3.2 million in income.
21 Direct sales taxes would be less than \$0.1 million, and direct income taxes, \$0.1 million. Based
22 on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), acreage
23 rental payments would be \$0.2 million and solar generating capacity payments would total at
24 least \$2.3 million.

25
26 Given the likelihood of local worker availability in the required occupational categories,
27 operation of a dish engine solar facility means that some in-migration of workers and their
28 families from outside the ROI would be required, with 8 persons in-migrating into the ROI.
29 Although in-migration may potentially affect local housing markets, the relatively small number
30 of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile
31 home parks) mean that the impact of solar facility operation on the number of vacant owner-
32 occupied housing units would not be expected to be large, with 8 owner-occupied units expected
33 to be required in the ROI.

34
35 No new community service employment would be required to meet existing levels of
36 service in the ROI.

37 38 39 **Photovoltaic**

40
41
42 **Construction.** Total construction employment impacts in the ROI (including direct and
43 indirect impacts) from the use of PV technologies would be up to 396 jobs (Table 8.1.19.2-5).
44 Construction activities would constitute less than 0.1% of total ROI employment. Such a solar
45 development would also produce \$23.4 million in income. Direct sales taxes would be
46 \$1.1 million, and direct income taxes, \$0.5 million.

TABLE 8.1.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Brenda SEZ with PV Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	132	7
Total	396	9
Income ^b		
Total	23.4	0.3
Direct state taxes ^b		
Sales	1.1	<0.1
Income	0.5	<0.1
BLM payments (\$ million 2008)		
Rental	NA ^c	0.2
Capacity ^d	NA	1.8
In-migrants (no.)	56	1
Vacant housing ^e (no.)	28	1
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that one facility with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c NA = not applicable.

^d The BLM annual capacity payment was based on a fee of \$5,256 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), assuming full buildout of the site.

^e Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

1 Given the scale of construction activities and the likelihood of local worker availability
2 in the required occupational categories, construction of a solar facility would mean that some
3 in-migration of workers and their families from outside the ROI would be required, with
4 56 persons in-migrating into the ROI. Although in-migration may potentially affect local housing
5 markets, the relatively small number of in-migrants and the availability of temporary
6 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
7 construction on the number of vacant rental housing units would not be expected to be large,
8 with 28 rental units expected to be occupied in the ROI. This occupancy rate would represent
9 less than 0.1% of the vacant rental units expected to be available in the ROI.

10
11 In addition to the potential impact on housing markets, in-migration would affect
12 community service (education, health, and public safety) employment. An increase in such
13 employment would be required to meet existing levels of service in the ROI. Accordingly,
14 1 new teacher would be required in the ROI. This increase would represent less than 0.1%
15 of total ROI employment expected in this occupation.

16
17
18 **Operations.** Total operations employment impacts in the ROI (including direct and
19 indirect impacts) of a build-out using PV technologies would be 9 jobs (Table 8.1.19.2-5).
20 Such a solar facility would also produce \$0.3 million in income. Direct sales taxes would be
21 less than \$0.1 million, and direct income taxes, less than \$0.1 million. Based on fees established
22 by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), acreage rental payments
23 would be \$0.2 million, and solar generating capacity payments would total at least \$1.8 million.

24
25 Given the likelihood of local worker availability in the required occupational categories,
26 operation of a solar facility would mean that some in-migration of workers and their families
27 from outside the ROI would be required, with one person in-migrating into the ROI. Although
28 in-migration may potentially affect local housing markets, the relatively small number of
29 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile
30 home parks) mean that the impact of solar facility operation on the number of vacant owner-
31 occupied housing units would not be expected to be large, with 1 owner-occupied unit expected
32 to be required in the ROI.

33
34 No new community service employment would be required to meet existing levels of
35 service in the ROI.

36 37 38 **8.1.19.3 SEZ-Specific Design Features and Design Feature Effectiveness**

39
40 No SEZ-specific design features addressing socioeconomic impacts have been identified
41 for the proposed Brenda SEZ. Implementing the programmatic design features described in
42 Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would reduce the
43 potential for socioeconomic impacts during all project phases.

1 **8.1.20 Environmental Justice**

2
3
4 **8.1.20.1 Affected Environment**

5
6 On February 11, 1994, the President signed Executive Order 12898 “Federal Actions to
7 Address Environmental Justice in Minority Populations and Low-Income Populations,” which
8 formally requires federal agencies to incorporate environmental justice as part of their missions
9 (*Federal Register*, Volume 59, page 76297, Feb.11, 1994). Specifically, it directs them to
10 address, as appropriate, any disproportionately high and adverse human health or environmental
11 effects of their actions, programs, or policies on minority and low-income populations.
12

13 The analysis of the impacts of solar energy projects on environmental justice issues
14 follows guidelines described in the Council on Environmental Quality’s (CEQ’s) *Environmental*
15 *Justice Guidance under the National Environmental Policy Act* (CEQ 1997). The analysis
16 method has three parts: (1) a description of the geographic distribution of low-income and
17 minority populations in the affected area is undertaken; (2) an assessment is conducted to
18 determine whether construction and operation would produce impacts that are high and adverse;
19 and (3) if impacts are high and adverse, a determination is made as to whether these impacts
20 disproportionately affect minority and low-income populations.
21

22 Construction and operation of a solar energy project in the proposed SEZ could affect
23 environmental justice if any adverse health and environmental impacts resulting from either
24 phase of development are significantly high and if these impacts disproportionately affect
25 minority and low-income populations. If the analysis determines that health and environmental
26 impacts are not significant, there can be no disproportionate impacts on minority and low-income
27 populations. In the event impacts are significant, disproportionality would be determined by
28 comparing the proximity of any high and adverse impacts with the location of low-income and
29 minority populations.
30

31 The analysis of environmental justice issues associated with the development of solar
32 facilities considered impacts within the SEZ and an associated 50-mi (80-km) radius around the
33 boundary of the SEZ. A description of the geographic distribution of minority and low-income
34 groups in the affected area was based on demographic data from the 2000 Census (U.S. Bureau
35 of the Census 2009k,1). The following definitions were used to define minority and low-income
36 population groups:
37

- 38 • **Minority.** Persons who identify themselves as belonging to any of the
39 following racial groups: (1) Hispanic, (2) Black (not of Hispanic origin) or
40 African American, (3) American Indian or Alaska Native, (4) Asian, or
41 (5) Native Hawaiian or Other Pacific Islander.
42

43 Beginning with the 2000 Census, where appropriate, the census form allows
44 individuals to designate multiple population group categories to reflect their
45 ethnic or racial origin. In addition, persons who classify themselves as being
46 of multiple racial origins may choose up to six racial groups as the basis of

1 their racial origins. The term minority includes all persons, including those
2 classifying themselves in multiple racial categories, except those who classify
3 themselves as not of Hispanic origin and as White or “Other Race”
4 (U.S. Bureau of the Census 2009k).

5
6 The CEQ guidance proposed that minority populations should be identified
7 where either (1) the minority population of the affected area exceeds 50% or
8 (2) the minority population percentage of the affected area is meaningfully
9 greater than the minority population percentage in the general population or
10 other appropriate unit of geographic analysis.

11
12 This PEIS applies both criteria in using the Census data for census block
13 groups, wherein consideration is given to the minority population that is both
14 greater than 50% and 20 percentage points higher than in the state (the
15 reference geographic unit).

- 16
17 • **Low-Income.** Individuals who fall below the poverty line. The poverty line
18 takes into account family size and age of individuals in the family. In 1999,
19 for example, the poverty line for a family of five with three children below
20 the age of 18 was \$19,882. For any given family below the poverty line, all
21 family members are considered as being below the poverty line for the
22 purposes of analysis (U.S. Bureau of the Census 2009I).

23
24 The data in Table 8.1.20.1-1 show the minority and low-income composition of total
25 population located in the proposed SEZ based on 2000 Census data and CEQ guidelines.
26 Individuals identifying themselves as Hispanic or Latino are included in the table as a separate
27 entry. However, because Hispanics can be of any race, this number also includes individuals
28 identifying themselves as being part of one or more of the population groups listed in the table.

29
30 A large number of minority and low-income individuals are located in the 50-mi (80-km)
31 area around the boundary of the SEZ. Within the 50-mi (80-km) radius in Arizona, 34.3% of the
32 population is classified as minority, while 19.2% is classified as low-income. The number of
33 minority individuals does not exceed 50% of the total population in the area and the number of
34 minority individuals does not exceed the state average by 20 percentage points or more; thus,
35 there is no minority population in the SEZ area based on 2000 Census data and CEQ guidelines.
36 The number of low-income individuals does not exceed the state average by 20 percentage points
37 or more and does not exceed 50% of the total population in the area; thus, there are no low-
38 income populations in the SEZ.

39
40 In the California portion of the 50-mi (80-km) radius, 52.3% of the population is
41 classified as minority, while 21.8% is classified as low-income. Although the number of minority
42 individuals does not exceed the state average by 20 percentage points or more, the number of
43 minority individuals exceeds 50% of the total population in the area; thus, there is a minority
44 population in the SEZ area based on 2000 Census data and CEQ guidelines. The number of low-
45 income individuals does not exceed the state average by 20 percentage points or more and does
46

TABLE 8.1.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Brenda SEZ

Parameter	Arizona	California
Total population	30,377	19,262
White, non-Hispanic	19,951	9,189
Hispanic or Latino	7,278	7,922
Non-Hispanic or Latino minorities	3,148	2,151
One race	2,686	1,800
Black or African American	262	1,255
American Indian or Alaskan Native	2,260	299
Asian	110	186
Native Hawaiian or Other Pacific Islander	12	37
Some other race	42	23
Two or more races	462	351
Total minority	10,426	10,073
Low-income	5,708	4,145
Percentage minority	34.3	52.3
State percentage minority	24.5	40.5
Percentage low-income	19.2	21.8
State percentage low-income	13.9	14.2

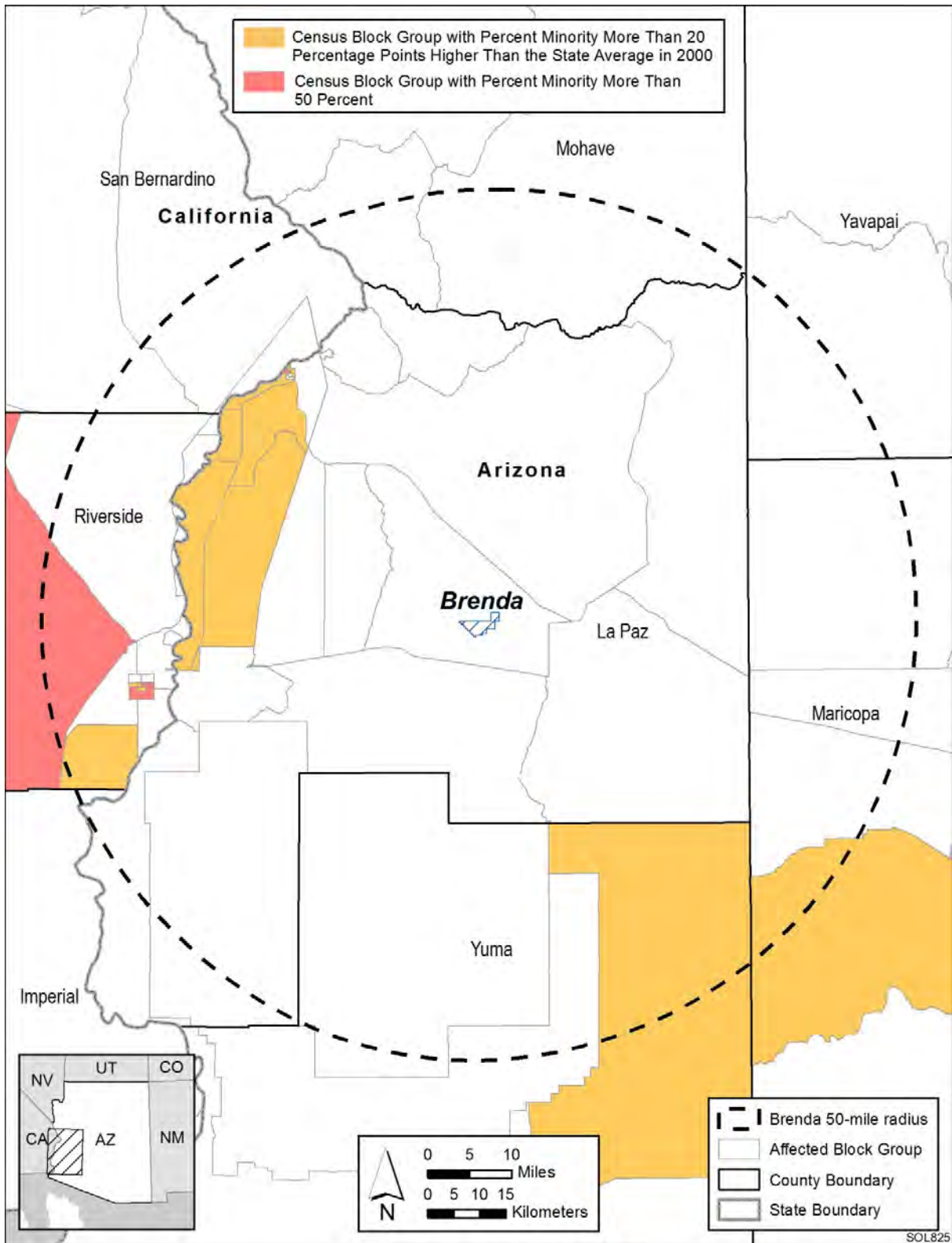
Sources: U.S. Bureau of the Census (2009k,1).

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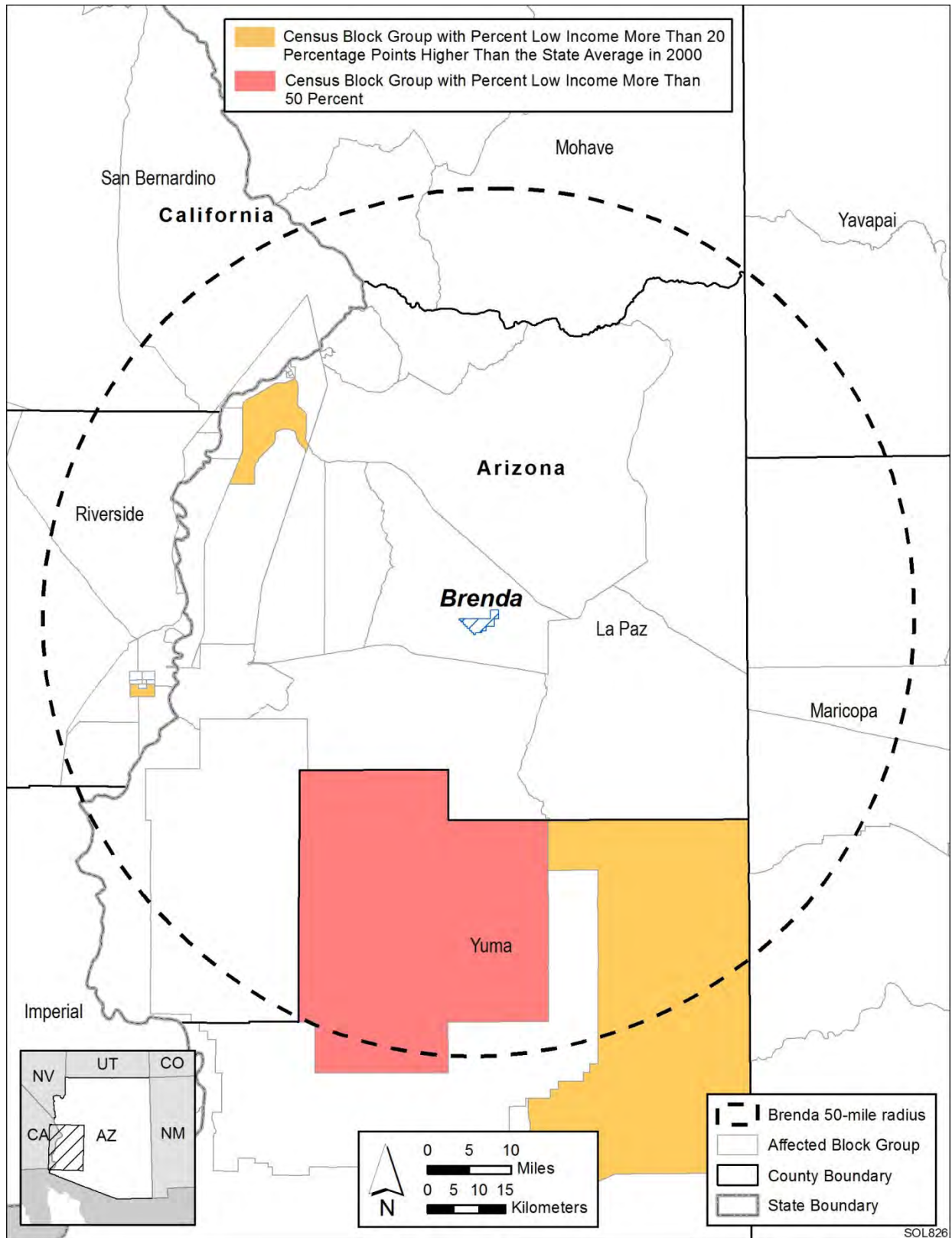
not exceed 50% of the total population in the area; thus, there are no low-income populations in the SEZ.

Figures 8.1.20.1-1 and 8.1.20.1-2 show the locations of the minority and low-income population groups, respectively, within the 50-mi (80-km) radius around the boundary of the SEZ.

At the individual block group level there are minority populations in numerous census block groups, located to the west and northwest of the SEZ, including the towns of Blythe and Parker and the Colorado River Indian Reservation, and to the southeast of the site, in Yuma County, where the minority population is more than 20 percentage points higher than the state average. There are also a number of block groups where the minority population exceeds 50% of the total population, located in the cities of Parker, Blythe, and in eastern Riverside County.



1
 2 **FIGURE 8.1.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding**
 3 **the Proposed Brenda SEZ**



1
 2 **FIGURE 8.1.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding**
 3 **the Proposed Brenda SEZ**

1 Census block groups with low-income populations more than 20 percentage points higher
2 than the state average are located to the northwest of the SEZ, including the Colorado River
3 Indian Reservation, in the city of Blyth, and to the southeast of the site, in Yuma County. There
4 is one block group where the low-income population exceeds 50% of the total population,
5 located to the south of the SEZ, in Yuma County.
6
7

8 **8.1.20.2 Impacts** 9

10 Environmental justice concerns common to all utility-scale solar energy facilities are
11 described in detail in Section 5.18. These impacts will be minimized through the implementation
12 of the programmatic design features described in Appendix A, Section A.2.2, which address the
13 underlying environmental impacts contributing to the concerns. The potentially relevant
14 environmental impacts associated with solar facilities within the proposed Brenda SEZ include
15 noise and dust during the construction; noise and electromagnetic field (EMF) effects associated
16 with operations; visual impacts of solar generation and auxiliary facilities, including transmission
17 lines; access to land used for economic, cultural, or religious purposes; and effects on property
18 values as areas of concern that might potentially affect minority and low-income populations.
19 Minority populations have been identified within 50 mi (80 km) of the proposed Brenda SEZ; no
20 low-income populations are present (Section 8.1.20.1).
21

22 Potential impacts on low-income and minority populations could be incurred as a result
23 of the construction and operation of solar facilities involving each of the four technologies.
24 Although impacts are likely to be small, there are minority populations defined by CEQ
25 guidelines (Section 8.1.20.1) within the 50-mi (80-km) radius around the boundary of the SEZ,
26 meaning that any adverse impacts of solar projects could disproportionately affect minority
27 populations. Because there are low-income populations within the 50-mi (80-km) radius, there
28 would be impacts on low-income populations.
29
30

31 **8.1.20.3 SEZ-Specific Design Features and Design Feature Effectiveness** 32

33 No SEZ-specific design features addressing environmental justice impacts have been
34 identified for the proposed Brenda SEZ. Implementing the programmatic design features
35 described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would
36 reduce the potential for environmental justice impacts during all project phases.
37
38
39

1 **8.1.21 Transportation**

2
3 The proposed Brenda SEZ is accessible by road and rail. One interstate highway (I-10)
4 and one U.S. highway (U.S. 60), as well as a regional railroad, serve the immediate area. A
5 number of smaller airports serve the area. General transportation considerations and impacts
6 are discussed in Sections 3.4 and 5.19, respectively.
7

8
9 **8.1.21.1 Affected Environment**

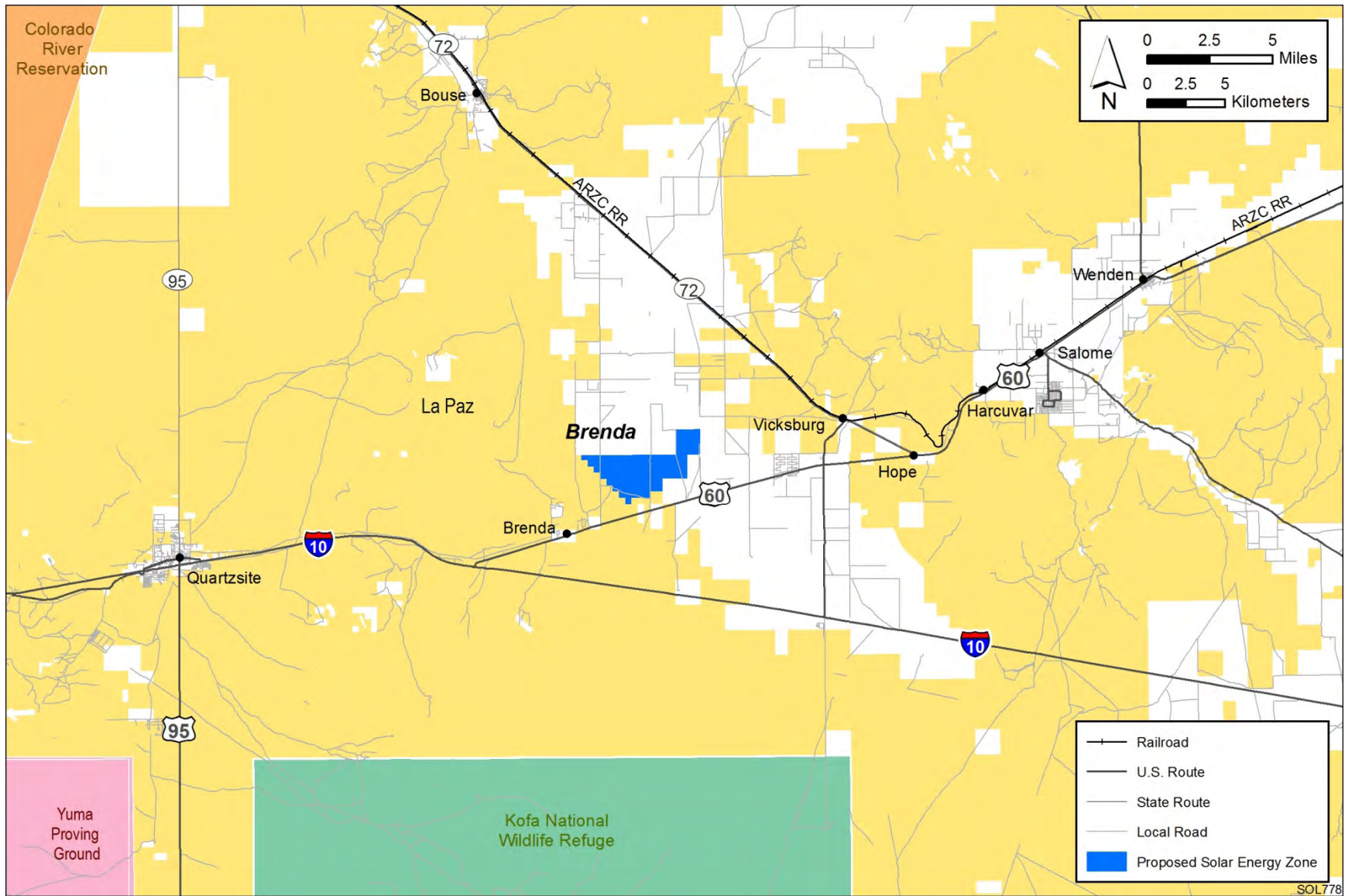
10
11 U.S. 60 runs southwest–northeast along the southeast border of the Brenda SEZ, as
12 shown in Figure 8.1.21.1-1. To the southwest, U.S. 60 terminates at I-10 about 6 mi (10 km)
13 away. The town of Quartzsite is an additional 12 mi (19 km) to the west along I-10. The small
14 town of Salome is 18 mi (29 km) northeast along U.S. 60. The western edge of the Phoenix
15 metropolitan area is approximately 100 mi (161 km) east of the SEZ along I-10. In the opposite
16 direction, the Los Angeles area is approximately 230 mi (370 km) away along I-10. Several local
17 unimproved dirt roads cross the SEZ. The area is designated for OHV travel as “limited to
18 designated roads and trails” (BLM 2007a). As listed in Table 8.1.21.1-1, U.S. 60 carries an
19 annual average daily traffic (AADT) volume of about 1,500 vehicles in the vicinity of the Brenda
20 SEZ (ADOT 2010).
21

22 The Arizona and California (ARZC) railroad serves the area (RailAmerica 2010). This
23 regional railroad originates in the west at Cadiz, California, where it has an interchange with
24 the Burlington Northern Santa Fe (BNSF) Railroad. The ARZC Railroad passes into Arizona
25 through Parker and travels southeast to Vicksburg, the closest rail stop to the Brenda SEZ,
26 about an 11-mi (18-km) drive. The railroad continues to Matthie (adjacent to Wickenburg
27 [70 mi (113 km)]) to the northeast, where it again has an interchange with the BNSF Railroad.
28

29 Four small airports open to the public are within a driving distance of approximately
30 85 mi (137 km) of the proposed Brenda SEZ, as listed in Table 8.1.21.1-2. None of these airports
31 have regularly scheduled passenger service. The nearest public airports are the Blythe and Avi
32 Suquilla Airports, which are both approximately 50 mi (80 km) away. The nearest large airports
33 are Sky Harbor in Phoenix (125 mi [201 km]) to the east and Yuma International in Yuma
34 (104 mi [167 km]) to the south. A number of additional smaller airports can be found in the
35 Phoenix area (>100 mi [161 km]) as well.
36
37

38 **8.1.21.2 Impacts**

39
40 As discussed in Section 5.19, the primary transportation impacts are anticipated to be
41 from commuting worker traffic. Single projects could involve up to 1,000 workers each day,
42 with an additional 2,000 vehicle trips per day (maximum). The volume of traffic on U.S. 60
43 would represent an increase in traffic of about 130% in the area of the Brenda SEZ for a solar
44 project. Such traffic levels would represent about a 10 or 100% increase in the traffic levels
45 experienced on I-10 or State Route 72 at their junctions with U.S. 60, respectively, if all project
46



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FIGURE 8.1.21.1-1 Local Transportation Network Serving the Proposed Brenda SEZ

TABLE 8.1.21.1-1 AADT on Major Roads near the Brenda SEZ for 2008

Road	General Direction	Location	AADT (Vehicles)
I-10	East–west	Exit 19 to exit 26 (east end of Quartzsite to Gold Nugget Road)	19,500
		Exit 26 to exit 31 (Gold Nugget Road to U.S. 60)	18,000
		Exit 31 to exit 45 (U.S. 60 to Vicksburg Road)	18,000
		Exit 45 to exit 53 (Vicksburg Road to Hovatter Road)	20,000
U.S. 60	Southwest–northeast	I-10 exit 31 to Vicksburg Road	1,500
		Vicksburg Road to State Route 72	1,500
		State Route 72 to Buckeye Road	2,500
		Buckeye Road to 2nd St. (in Wenden)	2,000
		2nd St. (in Wenden) to State Route 71	1,600
		State Route 71 to Wickenburg Airport Road	1,600
State Route 72	Northwest–southeast	U.S. 60 to Bousse	2,000
		Bousse to U.S. 95	2,600
State Route 95	North–south	I-10 to Tyson Drive (in Quartzsite)	3,300
		Tyson Drive (in Quartzsite) to State Route 72	2,500
		North of State Route 72 to Ehrenberg Road	5,200
U.S. 95	North–south	I-10 to Kuehn Road (in Quartzsite)	3,000
		Kuehn Road to La Paz Valley Road	1,400

Source: ADOT (2010).

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traffic were to be routed through I-10 or State Route 72. Because higher traffic volumes would be experienced during shift changes, traffic on I-10 or State Route 72 could experience minor slowdowns during these time periods in the area of their junctions with U.S. 60. Local road improvements would be necessary on any portion of U.S. 60 that might be developed so as not to overwhelm the local access roads near any site access point(s).

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. If there are any designated as open within the proposed SEZ, open routes crossing areas granted ROWs for solar facilities would be re-designated as closed. See Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated.

TABLE 8.1.21.1-2 Airports Open to the Public in the Vicinity of the Proposed Brenda SEZ

Airport	Location	Owner/Operator	Runway 1			Runway 2		
			Length (ft [m])	Type	Condition	Length (ft [m])	Type	Condition
Blythe	Off I-10, in Blythe, California, 48 mi (77 km) west of the SEZ	County of Riverside/ City of Blythe	5,800 (1,768)	Asphalt	Good	6,543 (1,994)	Asphalt	Good
Avi Suquilla	In Parker, approximately 52 mi (84 km) by way of U.S. 60 and State Route 72 northwest of the SEZ	Colorado River Indian Tribes	6,250 (1,905)	Asphalt	Good	NA ^A	NA	NA
Wickenburg Municipal	In Wickenburg, 70 mi (113 km) northeast off U.S. 60	Town of Wickenburg	6,100 (1,859)	Asphalt	Good	NA	NA	NA
Buckeye Municipal	In Buckeye, 85 mi (137 km) east near I-10 on the western edge of the Phoenix metropolitan area	Town of Buckeye	5,500 (1,676)	Asphalt	Good	NA	NA	NA

^a NA = not applicable.

Source: FAA (2010).

1 **8.1.21.3 SEZ-Specific Design Features and Design Feature Effectiveness**
2

3 No SEZ-specific design features have been identified related to impacts on transportation
4 systems around the proposed Brenda SEZ. The programmatic design features described in
5 Appendix A, Section A.2.2, including local road improvements, multiple site access locations,
6 staggered work schedules, and ride-sharing, would all provide some relief to traffic congestion
7 on local roads leading to the site. Depending on the location of solar facilities within the SEZ,
8 more specific access locations and local road improvements could be implemented.
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1 **8.1.22 Cumulative Impacts**
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3 The analysis presented in this section addresses the potential cumulative impacts in the
4 vicinity of the proposed Brenda SEZ in La Paz County, Arizona. The CEQ guidelines for
5 implementing NEPA define cumulative impacts as environment impacts resulting from the
6 incremental impacts of an action when added to other past, present, and reasonably foreseeable
7 future actions (40 CFR 1508.7). The impacts of other actions are considered without regard to
8 the agency (federal or nonfederal), organization, or person that undertakes them. The time frame
9 of this cumulative impacts assessment could appropriately include activities that would occur up
10 to 20 years in the future (the general time frame for PEIS analyses), but little or no information is
11 available for projects that could occur further than 5 to 10 years in the future.
12

13 The land surrounding the proposed Brenda SEZ is undeveloped with few permanent
14 residents living in the area. The nearest population centers are the small community of Brenda,
15 approximately 3 mi (5 km) southwest of the SEZ, and Vicksburg, about 6 mi (10 km) east of
16 the SEZ. Two RV parks are located on both sides of U.S. 60 in the town of Brenda. Irrigated
17 agricultural land is about 8 mi (13 km) east of the SEZ. The Plomosa Mountain range is about
18 5 mi (8 km) west of the SEZ. The New Water Mountains WA is about 7 mi (11 km) southwest
19 of the SEZ, and the Kofa NWR is about 10 mi (16 km) south of the SEZ. In addition, the Brenda
20 SEZ is located about 45 mi (72 km) northeast of the Bullard Wash SEZ. For some resources the
21 geographic extent of effects of the two SEZs overlap.
22

23 The geographic extent of the cumulative impacts analysis for potentially affected
24 resources near the proposed Brenda SEZ is identified in Section 8.1.22.1. An overview of
25 ongoing and reasonably foreseeable future actions is presented in Section 8.1.22.2. General
26 trends in population growth, energy demand, water availability, and climate change are
27 discussed in Section 8.1.22.3. Cumulative impacts for each resource area are discussed in
28 Section 8.1.22.4.
29

30
31 **8.1.22.1 Geographic Extent of the Cumulative Impacts Analysis**
32

33 The geographic extent of the cumulative impacts analysis for potentially affected
34 resources evaluated near the proposed Brenda SEZ is provided in Table 8.1.22.1-1. These
35 geographic areas define the boundaries encompassing potentially affected resources. Their
36 extent may vary based on the nature of the resource being evaluated and the distance at which
37 an impact may occur (thus, e.g., the evaluation of air quality may have a greater regional extent
38 of impact than visual resources). The BLM, the USFS, and the DoD administer most of the land
39 around the SEZ; the Colorado River Reservation Tribal lands are also about 25 mi (40 km)
40 northwest of the SEZ. The BLM administers approximately 58% of the lands within a 50-mi
41 (80-km) radius of the SEZ.
42
43
44

TABLE 8.1.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Brenda SEZ

Resource Area	Geographic Extent
Land Use	Primarily southern La Paz and northern Yuma Counties; also Mohave, Yavapai, and Maricopa Counties in Arizona and San Bernardino and Riverside Counties in California
Specially Designated Areas and Lands with Wilderness Characteristics	Within a 25-mi (40-km) radius of the Brenda SEZ
Rangeland Resources	
Grazing	Grazing allotments within 5 mi (8 km) of Brenda SEZ
Wild Horses and Burros	A 50-mi (80-km) radius from the Center of the Brenda SEZ
Recreation	Southern La Paz and northern Yuma Counties
Military and Civilian Aviation	Southern La Paz and northern Yuma Counties
Soil Resources	Areas within and adjacent to the Brenda SEZ
Minerals	Southern La Paz and northern Yuma Counties
Water Resources	
Surface water	Bouse Wash (intermittent stream); Alamo Wash and Cunningham Wash (both washes flow into the Bouse Wash); Colorado River
Groundwater	Ranegras Plain groundwater basin
Air Quality and Climate	A 31-mi (50-km) radius from the center of the Brenda SEZ
Vegetation, Wildlife and Aquatic Biota, Special Status Species	A 50-mi (80-km) radius from the center of the Brenda SEZ, including portions of La Paz, Yuma, Mohave, Yavapai, and Maricopa Counties in Arizona, and San Bernardino and Riverside Counties in California
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Brenda SEZ
Acoustic Environment (noise)	Areas adjacent to the Brenda SEZ
Paleontological Resources	Areas within and adjacent to the Brenda SEZ
Cultural Resources	Areas within and adjacent to the Brenda SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Brenda SEZ for other properties, such as traditional cultural properties
Native American Concerns	Areas within and adjacent to the Brenda SEZ; viewshed within a 25-mi (40-km) radius of the Brenda SEZ
Socioeconomics	A 50-mi (80-km) radius from the center of the Brenda SEZ
Environmental Justice	A 50-mi (80-km) radius from the center of the Brenda SEZ
Transportation	Interstate 10; U.S. 60 and U.S. 95

1 **8.1.22.2 Overview of Ongoing and Reasonably Foreseeable Future Actions**
2

3 The future actions described below are those that are “reasonably foreseeable;” that is,
4 they have already occurred, are ongoing, are funded for future implementation, or are included
5 in firm near-term plans. Types of proposals with firm near-term plans are as follows:
6

- 7 • Proposals for which NEPA documents are in preparation or finalized;
- 8
- 9 • Proposals in a detailed design phase;
- 10
- 11 • Proposals listed in formal NOIs published in the *Federal Register* or state
12 publications;
- 13
- 14 • Proposals for which enabling legislation has been passed; and
- 15
- 16 • Proposals that have been submitted to federal, state, or county regulators to
17 begin a permitting process.
18

19 Projects in the bidding or research phase or that have been put on hold were not included in the
20 cumulative impact analysis.
21

22 The ongoing and reasonably foreseeable future actions described below are grouped
23 into two categories: (1) actions that relate to energy production and distribution, including
24 foreseeable and potential solar energy projects within 50 mi (80 km) of the proposed SEZ
25 (Section 8.1.22.2.1); and (2) other ongoing and reasonably foreseeable actions, including those
26 related to mining and mineral processing, grazing management, transportation, recreation, water
27 management, and conservation (Section 8.1.22.2.2). Together, these actions and trends have the
28 potential to affect human and environmental receptors within the geographic range of potential
29 impacts over the next 20 years.
30

31
32 **8.1.22.2.1 Energy Production and Distribution**
33

34 In November 2006, the Arizona Corporation Commission adopted final rules to expand
35 the state’s Renewable Energy Standard to 15% by 2025, with 30% of the renewable energy to be
36 derived from distributed energy (DSIRE 2010).
37

38 Reasonably foreseeable future actions related to renewable energy production and energy
39 distribution within 50 mi (80 km) of the proposed Brenda SEZ are identified in Table 8.1.22.2-1
40 and are described in the following sections. One solar energy project was identified, but no
41 foreseeable wind or geothermal projects have been identified.
42
43
44

TABLE 8.1.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Brenda SEZ^a

Description	Status	Resources Affected	Primary Impact Location
<i>Fast-Track Solar Energy Projects on BLM-Administered Land</i>			
Solar Millennium Blythe Solar Project (CACA 48811), 986-MW trough facility; 9,480 total acres	NOI to prepare an EIS issued on Nov. 23, 2009	Land use, visual, terrestrial habitats, wildlife, groundwater	About 45 mi (72 km) west of Brenda SEZ, within Riverside East SEZ
<i>Transmission and Distribution Systems</i>			
None			

2

3

4

Renewable Energy Development

5

6 Renewable energy ROW applications are considered in two categories, fast-track and
7 regular-track applications. Fast-track applications, which apply principally to solar energy
8 facilities, are those applications on public lands for which the environmental review and public
9 participation process is under way and the applications could be approved by December 2010. A
10 fast-track project would be considered foreseeable, because the permitting and environmental
11 review processes would be under way. There is one fast-track project application within 50 mi
12 (80 km) of the proposed Brenda SEZ. Regular-track proposals are considered potential future
13 projects, but not necessarily foreseeable projects, since not all applications would be expected to
14 be carried to completion. These proposals are considered together as a general level of interest in
15 development of renewable energy in the region.

16

17 Table 8.1.22.2-1 lists one foreseeable fast-track solar energy project, the Solar
18 Millennium Blythe Solar Project. The location of the project is shown on Figure 8.1.22.2-1.
19 Other, more numerous, pending regular-track ROW applications shown in the figure are
20 discussed collectively at the end of this section. No major new transmission projects have been
21 identified.

22

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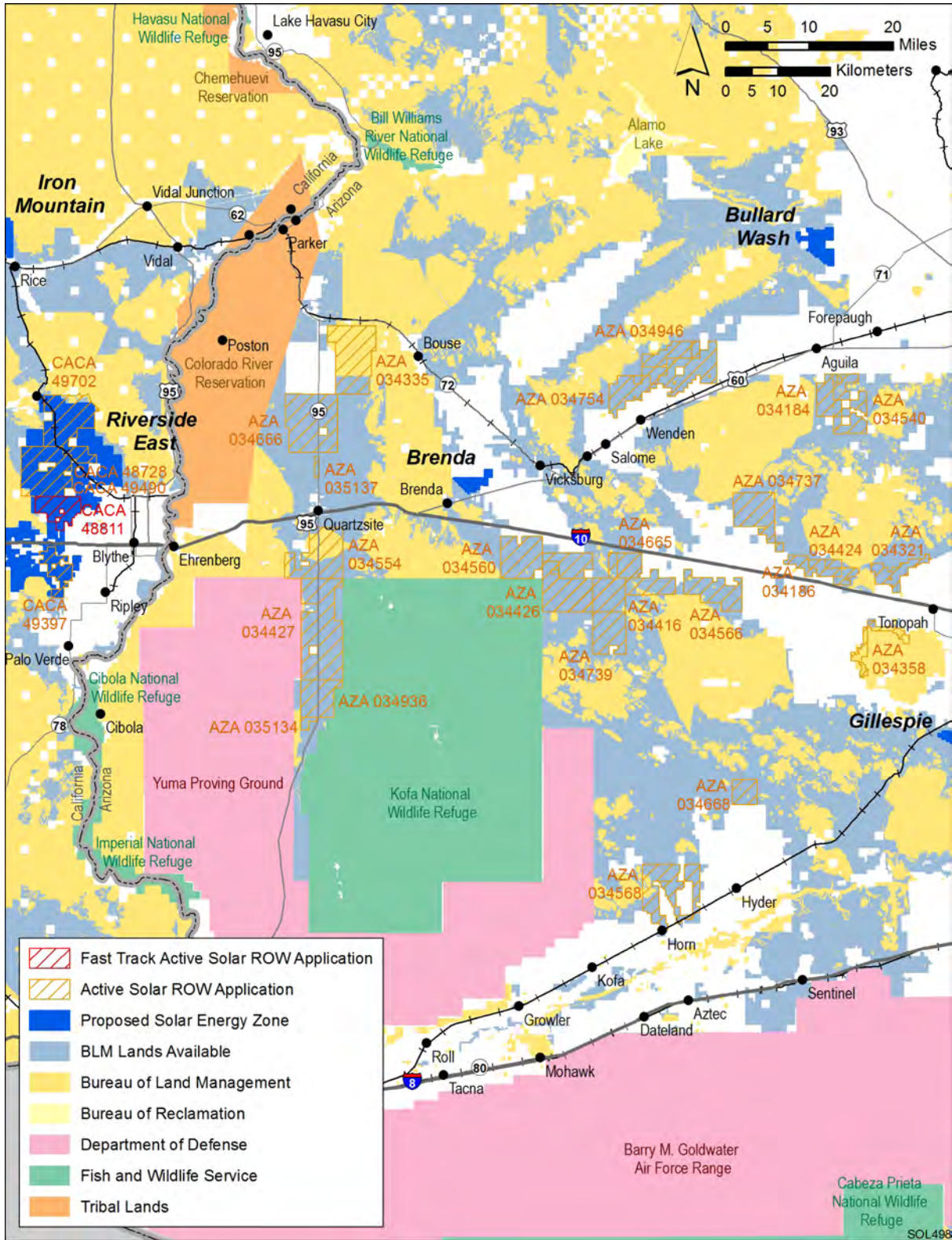
24

Foreseeable Renewable Energy Project

25

26

27 ***Solar Millennium Blythe Solar Project (CACA 48811)***. This proposed fast-track project
28 would be a parabolic trough facility with an output of 986 MW. The project site would be on
29 public land within the eastern portion of proposed Riverside East SEZ, approximately 8 mi
30 (13 km) west of Blythe, California, adjacent to the I-10 transmission corridor. The proposed
31 facility would occupy approximately 9,480 acres (38.4 km²) and disturb about 7,030 acres



3 **FIGURE 8.1.22.2-1 Locations of Renewable Energy Project ROW Applications within a 50-mi**
 4 **(80-km) Radius of the Proposed Brenda SEZ**

1 (28.5 km²). The facility would employ four adjacent and independent solar troughs with nominal
2 output of 250 MW each. It would employ dry cooling and would require about 600 ac-ft/yr
3 (0.74 million m³/yr) of groundwater drawn from two on-site wells for mirror washing and other
4 uses. Water requirements during the proposed 2011 to 2015 construction period are estimated
5 to be 620 ac-ft/yr (0.77 million m³/yr). The facility would connect to a planned new substation,
6 the Colorado River Substation, to be built approximately 5 mi (8 km) southwest of the project
7 location. To supply auxiliary boilers, a 10-mi (16-km) long natural gas pipeline would be built
8 to connect to an existing pipeline south of I-10. An average of 604 workers would be employed
9 during construction of the facility and 221 full-time employees would be required for operations
10 (BLM and CEC 2010).

11
12 Project construction would result in a direct loss of low- to moderate-quality habitat
13 for desert tortoise over the project site and would fragment and degrade adjacent native plant
14 and wildlife communities. The project could also promote the spread of invasive non-native
15 plants and desert tortoise predators such as ravens. Five species of California-listed sensitive
16 plant species are present. Habitat is also present for Western burrowing owl, loggerhead
17 shrike, Le Conte's thrasher, black-tailed gnatcatcher, and California horned lark (BLM and
18 CEC 2010).

21 **Pending Solar Applications on BLM-Administered Lands**

22
23 In addition to the fast-track solar project described above, 28 regular-track ROW
24 applications for solar projects have been submitted to the BLM that would be located within
25 50 mi (80 km) of the SEZ. Table 8.1.22.2-2 provides a list of all solar projects that had pending
26 applications submitted to BLM as of March 2010 (BLM and USFS 2010b). Figure 8.1.22.2-1
27 shows the locations of these applications. There are no pending wind or geothermal ROW
28 applications within this distance.

29
30 The likelihood of any of the regular-track application projects actually being developed is
31 uncertain but is generally assumed to be less than that for fast-track applications. The projects
32 are all listed in Table 8.1.22.2-2 for completeness and as an indication of the level of interest in
33 development of solar energy in the region. Some, but not all, of these applications would be
34 expected to result in actual projects. Thus, the cumulative impacts of these potential projects are
35 analyzed in their aggregate effects.

36
37 The following description of the Quartzsite Solar Energy Project is an example of one of
38 the pending regular-track solar applications. The description gives an indication of the status of
39 the development and approval of the proposed project.

40
41
42 ***Quartzsite Solar Energy Project (AZA 34666).*** Quartzsite Solar Energy proposes to
43 construct a 100-MW CSP/tower facility in La Paz County, Arizona, about 10 mi (16 km) west-
44 northwest of the Brenda SEZ. The project would also include a thermal energy storage system.
45 The generation plant, power line, and ancillary facilities would be on BLM-administered land

TABLE 8.1.22.2-2 Pending Renewable Energy Project ROW Applications on BLM-Administered Land within 50 mi of the Proposed Brenda SEZ^a

Serial Number	Applicant	Application Received	Size (acres) ^b	MW	Technology	Status (NOI Date)	Field Office
<i>Solar Applications</i>							
AZA 034184	Boulevard Assoc. LLC (Aguila)	June 26, 2007	7,375	500	CSP/trough	Pending	Hassayampa
AZA 034186	Boulevard Assoc., LLC (Big Horn)	June 26, 2007	6,232	500	CSP/trough	Pending	Hassayampa
AZA 034321	Ausra Az II, LLC (Palo Verde)	Oct. 1, 2007	5,748	840	CSP/CLFR	Pending	Hassayampa
AZA 034335	Boulevard Assoc., LLC	June 8, 2007	24,221	500	CSP/trough	Pending	Lake Havasu: Yuma
AZA 034358	First Solar (Saddle Mtn.)	Nov. 6, 2007	5,997	300	PV	Pending	Lower Sonoran
AZA 034416	Pacific Solar Invst., Inc. (Iberdrola) (Eagle Trail)	Dec. 2, 2007	19,000	1,500	CSP/trough	Pending	Yuma
AZA 034424	Pacific Solar Invst., Inc. (Iberdrola) (Big Horn)	Dec. 4, 2007	13,440	900	CSP	Pending	Hassayampa
AZA 034426	Pacific Solar Invst., Inc. (Iberdrola) (Ranegras)	Dec. 2, 2007	25,860	2,000	CSP/trough	Pending	Yuma
AZA 034427	Pacific Solar Invst., Inc. (Iberdrola)	Sept. 6, 2007	32,000	2,000	CSP/trough	Pending	Yuma
AZA 034540	Horizon Wind Energy, LLC (Aguila)	March 4, 2008	11,535	250	CSP/trough	Pending	Hassayampa
AZA 034554	Nextlight Renewable Power, LLC	March 26, 2008	20,699	500	CSP/trough	Pending	Yuma
AZA 034560	Nextlight Renewable Power, LLC	March 26, 2008	15,040	500	CSP/trough	Pending	Yuma
AZA 034566	Nextlight Renewable Power, LLC	March 26, 2008	13,428	500	CSP/trough	Pending	Yuma
AZA 034568	Nextlight Renewable Power, LLC (Palomas)	March 26, 2008	20,165	500	CSP/tough	Pending	Yuma
AZA 034665	Solarreserve, LLC (Black Rack Hill)	May 27, 2008	5,600	600	CSP/tower	Pending	Yuma
AZA 034666	Solarreserve, LLC (Quartzsite)	May 27, 2008	25,204	100	CSP/tower	Jan. 14, 2010	Yuma
AZA 034668	Solarreserve, LLC (Agua Caliente)	May 27, 2008	5,678	600	CSP/tower	Pending	Yuma
AZA 034737	Arizona Solar Invst., Inc. (Haraquahala)	July 10, 2008	14,047	500	CSP/trough	Pending	Hassayampa
AZA 034739	IDIT, Inc.	July 9, 2008	15,000	1,000	CSP/trough	Pending	Yuma
AZA 034754	Horizon Wind Energy, LLC	March 4, 2008	28,760	250	CSP/trough	Pending	Lake Havasu
AZA 034936	Wildcat Quartzsite, LLC	Jan. 29, 2009	11,960	800	CSP/tower	Pending	Yuma
AZA 034946	Wildcat Harcuvar South, LLC	Jan. 28, 2009	10,947	800	CSP/tower	Pending	Lake Havasu
AZA 035134	E-On Climate & Renewables (La Posa)	July 2, 2009	1,780	–	–	Pending	Yuma
AZA 035137	E-On Climate & Renewables (Castle Dome)	July 2, 2009	590	100	PV	Pending	Yuma
CACA 48728	FPL Energy	Jan. 31, 2007	20,608	250	CSP	Pending	Palm Springs-Southcoast
CACA 49397	First Solar (Desert Quartzite)	Sept. 28, 2007	7,548	600	PV	Pending	Palm Springs-Southcoast
CACA 49490	Enxco, Inc.	Nov. 13, 2007	20,608	300	CSP	Pending	Palm Springs-Southcoast
CACA 49702	Bull Frog Green Energy, LLC	June 1, 2008	22,717	2,500	PV	Pending	Palm Springs-Southcoast

^a Total 28 solar application acres = 421,268; total solar MW = 20,658.

^b To convert acres to km², multiply by 0.004047.

1 (BLM 2010e). The lead federal agency dealing with the Quartzsite Solar Energy application is
2 the Western Area Power Authority (WAPA); the BLM is a cooperating agency. WAPA intends
3 to prepare an EIS on the application. The applicant has applied to WAPA to interconnect the
4 proposed project to WAPA's transmission system.
5
6

7 **8.1.22.2.2 Other Actions**

8

9 Other major ongoing and foreseeable actions identified within 50 mi (80 km) of the
10 proposed Brenda SEZ are listed in Table 8.1.22.2-3 and are described in the following
11 subsections.
12
13

14 **Other Ongoing Actions**

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16

17 ***Palo Verde–Devers 500-kV Transmission Line.*** The existing Palo Verde–Devers 500-kV
18 transmission line route connects the Palo Verde Nuclear Generating Station with the Devers
19 Substation in California west of Palm Springs. This line runs through the northern portion of
20 the Kofa NWR and is about 20 mi (32 km) south of the Brenda SEZ at its nearest point.
21
22

23 ***Bouse-Kofa 161-kV Transmission Line.*** The Western Area Power Association Bouse-
24 Kofa 161-kV transmission line parallels U.S. 95 in the vicinity of Quartzsite and will be
25 connected to the Quartzsite Solar Energy Project currently under review (*Federal Register*
26 Vol. 75, No. 9, pp. 2133–2134 January 14, 2010).
27
28

29 ***Parker Dam and Powerplant.*** Parker Dam is located on the Colorado River, 17 mi
30 (27 km) northeast of the town of Parker and about 40 mi (64 km) northwest of the SEZ. The
31 reservoir behind the dam is 20,390 acres (82.5 km²). The hydroelectric power plant, located on
32 the California side of the river, houses four 30-MW hydroelectric generating units. The plant
33 has been operating since 1942 (U.S. Bureau of Reclamation 2003).
34
35

36 **Other Foreseeable Actions**

37
38

39 ***Proposed Reopening of the Copperstone Mine.*** American Bonanza proposes to reopen
40 the Copperstone Mine located 9.5 mi (15 km) north of Quartzsite and 18 mi (29 km) northwest
41 of the SEZ. The mine, operated from 1987 until 1992, consisted of an open pit, ore-crushing
42 facility, cyanide heap-leaching and vat-leaching gold recovery systems, a tailing pond, and waste
43 rock dump. The project area to be reopened consists of 335 contiguous unpatented lode mining
44 claims, and the project expects to mine and mill 450 tons (457,000 kg) per day of ore, producing
45 35,000 to 55,000 ounces (1,090 to 1,710 kg) of gold per year for 7 to 10 years (BLM 2010f).
46

TABLE 8.1.22.2-3 Other Major Actions near the Proposed Brenda SEZ^a

Description	Status	Resources Affected	Primary Impact Location
Palo Verde–Devers 500-kV Transmission Line	Operating	Terrestrial habitat, wildlife, vegetation, visual	Corridor passes 20 mi (32 km) south of the SEZ
Bouse-Kofa 161-kV Transmission Line	Operating	Terrestrial habitat, wildlife, vegetation, visual	Corridor runs parallel to U.S. 95 in Quartzsite, Ariz., about 18 mi (29 km) west of the SEZ
Parker Dam and Powerplant	Operating since 1942	Aquatic biota	40 mi (64 km) northwest of the SEZ
Reopening of the Copperstone Mine	EA May 2010	Groundwater, terrestrial habitat, wildlife, air quality, noise/vibration, cultural, visual	9.5 (15 km) north of Quartzite and 18 mi (29 km) northwest of the SEZ
Wild Burro Reduction Cibola-Trigo Herd Management Area	EA July 2010	Terrestrial habitat, wildlife	About 20 mi (32-km) west of the SEZ
Impact Area Expansion Yuma Proving Ground	EA March 2010	Terrestrial habitat, wildlife	Boundary about 30 mi (48 km) south–southwest of the SEZ
Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National Wildlife Refuge	EA Dec. 2009	Wildlife	Boundary 10 mi (16 km) south of the SEZ
Algae Biomass Project	Private Enterprise expected to begin operation in 2010	Land use, terrestrial habitat, visual	Near Vicksburg, about 6 mi (10 km) east of the SEZ

^a Projects operating or in later stages of agency environmental review and project development.

1 **Wild Burro Reduction Cibola-Trigo HMA.** The BLM Yuma Field Office proposes to
2 remove 100 excess wild burros from the Cibola-Trigo HMA, approximately 20 mi (32 km) west
3 of the SEZ. The HMA is 635,685 acres (2752 km²) of federal, state, military withdrawn, and
4 private lands (BLM 2010g).

5
6
7 **Impact Area Expansion Yuma Proving Ground.** The Yuma Proving Ground
8 encompasses about 836,000 acres (3,380 km²). The closest boundaries to the SEZ are about
9 30 mi (48 km) to the south and southwest. The Kofa Region (374,600 acres [1516 km²]) has
10 been heavily contaminated from munitions testing since the early 1950s. The Army is proposing
11 to expand the existing designated impact areas in the region. The proposed impact areas would
12 encompass approximately 80,000 acres (325 km²) (U.S. Army Garrison Yuma Proving
13 Ground 2010).

14
15
16 **Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National**
17 **Wildlife Refuge.** The USFWS proposes to limit predation by mountain lions on desert bighorn
18 sheep in the Kofa NWR, 10 mi (16 km) south of the SEZ. This would include removal of
19 “offending” mountain lions by either lethal means or translocation. An offending mountain lion
20 is defined as one that has killed two or more desert bighorn sheep within a 6-month period
21 (USFWS 2009b).

22
23
24 **Algae Biomass Project.** Phyco BioSciences, Inc. intends to develop a 160-acre
25 (0.65-km²) algae biomass project near Vicksburg, Arizona, about 6 mi (10 km) east of the
26 SEZ. Four 40-acre (0.16-km²) fields will produce 7,500 tons (7,600 metric tons) per year of dry
27 algae solids that will be processed at an algae mill. The final products include extracted oils
28 to be converted to biofuels, nutritional oils, and dry algae meal for pet foods and animal feed
29 (XL Renewables 2009).

30 31 32 **Grazing Allotments**

33
34 One grazing allotment exists in the Brenda SEZ. The Crowder-Weisser authorization
35 includes 234,645 acres (950 km²) of public lands and permits grazing by 1,450 cattle (equivalent
36 to 1,578 AUMs) each year through February 2018.

37 38 39 **Mining**

40
41 The BLM Geocommunicator Database (BLM and USFS 2010a) shows four active
42 mining placer claims on file with BLM about 3 to 5 mi (5 to 8 km) from the southwest boundary
43 of the Brenda SEZ.

1 **8.1.22.3 General Trends**

2
3
4 **8.1.22.3.1 Population Growth**

5
6 Over the period 2000 to 2008, the counties in the ROI experienced growth in population.
7 The population in La Paz County grew at an annual rate of 0.2%; Yuma County grew by 2.4%;
8 and Riverside County grew by 3.8%. The population of the ROI in 2008 was 2,301,221, having
9 grown at an average annual rate of 3.7% since 2000. The growth rate for the state of Arizona as
10 a whole was 3.0% (Section 8.1.19.1.5).

11
12
13 **8.1.22.3.2 Energy Demand**

14
15 The growth in energy demand is related to population growth through increases in
16 housing, commercial floorspace, transportation, manufacturing, and services. Given that the
17 population in La Paz and Yuma Counties is expected to grow between 2006 and 2016, an
18 increase in energy demand is also expected. However, the EIA projects a decline in per-capita
19 energy use through 2030, mainly because of the high cost of oil and improvements in energy
20 efficiency throughout the projection period. Primary energy consumption in the United States
21 between 2007 and 2030 is expected to grow by about 0.5% each year; the fastest growth is
22 projected for the commercial sector (at 1.1% each year). Transportation, residential, and
23 industrial energy consumption are expected to grow by about 0.5, 0.4, and 0.1% each year,
24 respectively (EIA 2009).

25
26
27 **8.1.22.3.3 Water Availability**

28
29 As described in Section 8.1.9.1.2, depth to groundwater in the Ranegras Plain Basin
30 varies from 438 ft (134 m) to 75 ft (23 m) below ground surface. Groundwater depth in the
31 proposed Brenda SEZ ranges from 158 to 239 ft (48 to 73 m) below ground surface and has
32 declined at an average rate of 0.34 to 4.6 in./yr (0.85 to 11.5 cm/yr) between 1948 and 2006.
33 There is an estimated 21.7 million ac-ft (26.8 billion m³) of water available in the basin, and
34 natural recharge estimates range from less than 1,000 ac-ft/yr (1.2 million m³/yr) to more than
35 6,000 ac-ft/yr (7.4 million m³/yr).

36
37 Recorded water level declines from 1945 to 2006 ranged from 25 to 146 ft (7.6 to 44 m)
38 throughout the Ranegras Plain Basin, but have rebounded up to 60 ft (18 m) in some locations.
39 The withdrawals have caused a cone of depression to form in the eastern part of the basin,
40 approximately 10 mi (16 km) from the Brenda SEZ. Subsidence of the land surface of up to 4 in.
41 (10 cm) has also occurred in the area of highest drawdown of the aquifer (Section 8.1.9.1.2).

42
43 In 2005, water withdrawals from surface waters and groundwater in La Paz County
44 were 704,009 ac-ft/yr (86 million m³/yr), of which 87% came from surface waters and
45 13% came from groundwater. The largest water use category was irrigation, at 698,886 ac-ft/yr
46 (86 million m³/yr), while public supply/domestic water uses were 4,697 ac-ft/yr

1 (5.7 billion m³/yr), and mining water uses were on the order of 303 ac-ft/yr (386,000 m³/yr).
2 Annual groundwater withdrawals within the Ranegras Plain Basin have averaged about
3 30,000 ac-ft since 1991 and have likewise been dominated by agriculture (Section 8.1.9.1.3).
4
5

6 **8.1.22.3.4 Climate Change**

7

8 A report on global climate change in the United States prepared by the U.S. Global
9 Research Program (GRCP 2009) documents current temperature and precipitation conditions
10 and historic trends. Excerpts of the conclusions from this report indicate the following for the
11 Southwest region of the United States, which includes Arizona:
12

- 13 • Decreased precipitation, with a greater percentage of that precipitation coming
14 from rain, will result in a greater likelihood of winter and spring flooding and
15 decreased stream flow in the summer.
16
- 17 • Increased frequency and altered timing of flooding have occurred. For
18 example, winter precipitation in Arizona is already becoming more variable,
19 with a trend toward both more frequent extremely dry and extremely wet
20 winters.
21
- 22 • The average temperature in the Southwest has already increased by about
23 1.5°F (0.8°C) compared to a 1960 to 1979 baseline, and by the end of the
24 century, the average annual temperature is projected to rise 4°F to 10°F
25 (2°C to 6°C).
26
- 27 • A warming climate and the related reduction in spring snowpack and soil
28 moisture have increased the length of the wildfire season and intensity of
29 forest fires.
30
- 31 • Later snow and less snow coverage in ski resort areas could force ski areas
32 to shut down before the season would otherwise end.
33
- 34 • Much of the Southwest has experienced drought conditions since 1999. This
35 represents the most severe drought in the last 110 years. Projections indicate
36 an increasing probability of drought in the region.
37
- 38 • As temperatures rise, the landscape will be altered as species shift their ranges
39 northward and upward to cooler climates.
40
- 41 • Temperature increases, when combined with urban heat island effects for
42 major cities such as Phoenix, present significant stress to health and electricity
43 and water supplies.
44

- Increased minimum temperatures and warmer springs extend the range and lifetime of many pests that stress trees and crops, and lead to northward migration of weed species.

8.1.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Brenda SEZ on the basis of the following assumptions: (1) because of the small size of the proposed SEZ (<10,000 acres [$<40.5 \text{ km}^2$]), only one project would be constructed at a time, and (2) maximum total disturbance over 20 years would be about 3,102 acres (12.6 km^2) (80% of the entire proposed SEZ). For this analysis, it is also assumed that no more than 3,000 acres (12.1 km^2) would be disturbed per project annually and 250 acres (1.01 km^2) monthly on the basis of construction schedules planned in current applications. It is also assumed that 575 acres (2.3 km^2) would be disturbed to construct 19 mi (30 km) of new transmission line to reach an existing 161-kV line and to connect to the regional grid. Regarding site access, the nearest major road is U.S. 60, which runs along the southeastern border of the SEZ. It is assumed that no new access road would need to be constructed to support solar development in the SEZ.

Cumulative impacts that would result from the construction, operation, and decommissioning of solar energy development projects within the proposed SEZ when added to other past, present, and reasonably foreseeable future actions described in the previous section in each resource area are discussed below. At this stage of development, because of the uncertain nature of future projects in terms of size, number, and location within the proposed SEZ, and the types of technology that would be employed, the impacts are discussed qualitatively or semiquantitatively, with ranges given as appropriate. More detailed analyses of cumulative impacts would be performed in the environmental reviews for the specific projects in relation to all other existing and proposed projects in the geographic area.

8.1.22.4.1 Lands and Realty

The area covered by the proposed Brenda SEZ is largely isolated and undeveloped. In general, the areas surrounding the SEZ are rural in nature. U.S. 60, which runs within a half mile of the southern boundary, would provide access to the southern portion of the SEZ, while a county road crosses through the western portion of the SEZ (Section 8.1.2.1).

Development of the SEZ for utility-scale solar energy production would establish an isolated, industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Since the SEZ is rural and undeveloped, utility-scale solar energy development would be a new and dominant land use in the area. Access to such areas by both the general public and much wildlife would be eliminated.

As shown in Table 8.1.22.2-2 and Figure 8.1.22.2-1, there is one fast-track solar application, one pending solar development application, one pending wind site testing application, and 28 other pending solar applications on public land within a 50-mi (80-km)

1 radius of the proposed Brenda SEZ. There are currently no wind or geothermal applications
2 within this distance and no solar applications within the SEZ. The Solar Millennium Blythe
3 Solar Energy Project fast-track solar application lies about 45 mi (72 km) west of the SEZ.
4 The large number of pending solar energy applications indicates strong interest in solar energy
5 development within 50 mi (80 km) of the proposed SEZ, but only the fast-track solar application
6 is considered a firmly foreseeable development (Section 8.1.22.2.1).
7

8 The other foreseeable projects on private land identified in Section 8.1.22.2.2 are small in
9 number and size and would have minimal impacts on land use near the SEZ.
10

11 The development of utility-scale solar projects in the proposed Brenda SEZ in
12 combination with other ongoing, foreseeable, and potential actions within the geographic extent
13 of effects, nominally 50 mi (80 km), could have cumulative effects on land use in the vicinity of
14 the proposed SEZ. Ongoing, foreseeable, and potential actions on or near the SEZ could result in
15 small cumulative impacts on land use through impacts on land access and use for other purposes,
16 on groundwater availability, and on visual resources, especially if the SEZ is fully developed
17 with solar projects. Cumulative impacts on land use could rise to moderate if a major portion of
18 the pending solar applications in the region were to result in actual projects, but projects within
19 the SEZ would make only a small contribution to cumulative impacts because of its relatively
20 small size.
21

22 ***8.1.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics***

23 There are eight specially designated areas within 25 mi (40 km) of the proposed Brenda
24 SEZ in Arizona that potentially could be affected by solar energy development within the SEZ.
25 Most of these areas are more than 5 mi (8 km) from the SEZ (Section 8.1.3.1). Potential exists
26 for cumulative visual impacts on these areas from the construction of utility-scale solar energy
27 facilities within the SEZ and outside the SEZ within the geographic extent of effects and from
28 the construction of transmission lines and roads outside the SEZ that would serve both. The
29 exact nature of cumulative visual impacts on the users of these areas would depend on the
30 specific solar technologies employed and the locations of solar facilities, transmission lines, and
31 roads actually built within and outside the SEZ. About 10 pending solar applications lie within
32 25 mi (40 km) of the proposed SEZ (Figure 8.1.22.2-1), some of which, if built, would affect
33 some of the same sensitive areas as facilities built within the SEZ. Such effects could include
34 visual impacts, wilderness characteristics, reduced accessibility, and ecological effects.
35
36
37
38

39 ***8.1.22.4.3 Rangeland Resources***

40 The proposed Brenda SEZ contains less than 2% of one perennial grazing allotment
41 (Section 8.1.4.1.1). If utility-scale solar facilities were constructed on the SEZ, those areas
42 occupied by the solar projects would be excluded from grazing. The development of other
43 potential solar energy projects within 50 mi (80 km) of the SEZ could result in cumulative
44 impacts on grazing due to the number and relative proximity of several of the proposed facilities
45

1 to the proposed SEZ. However, the contribution of such effects from projects within the SEZ
2 would be minimal due to the small area affected.

3
4 A number of BLM HMAs and HAs occur within the 50-mi (80-km) SEZ region for the
5 proposed Brenda SEZ (Section 8.1.4.2.1), but none occur within the proposed SEZ or within the
6 5-mi (8-km) area of indirect effects. Thus, solar developments in the SEZ would not contribute
7 to cumulative effects on wild horses and burros.

8 9 10 **8.1.22.4.4 Recreation**

11
12 Limited outdoor recreation, mainly OHV use, occurs in the area of the proposed SEZ
13 (Section 8.1.5.1). While there are no current solar applications within the proposed SEZ,
14 construction of utility-scale solar projects on the SEZ would preclude recreational use of the
15 affected lands for the duration of the projects. Road closures and access restrictions within the
16 proposed SEZ would affect OHV use in particular. However, such effects are expected to be
17 small due to low current use. Foreseeable and potential actions, mainly pending solar
18 applications, would also affect areas of low recreational use and would have similar minimal
19 effects on current recreational activities individually. However, small cumulative impacts on
20 recreation within the geographic extent of effects, for example on hunting opportunities, might
21 be possible from the aggregate presence of several new solar facilities within the area if a large
22 number of projects with pending applications are ultimately built.

23 24 25 **8.1.22.4.5 Military and Civilian Aviation**

26
27 The entire proposed SEZ is covered by a total of three MTRs with 300-ft (91-m) AGL
28 operating limits (Section 8.1.6.1). The military has indicated that construction of solar or
29 transmission facilities in excess of 250 ft (76 m) tall would adversely affect the use of the MTRs
30 (Section 8.1.6.2). Potential new solar facilities and associated new transmission lines outside the
31 SEZ could present additional concerns for military aviation, depending on the eventual location
32 of such facilities with respect to training routes, and thus could result in cumulative impacts on
33 military aviation. The closest civilian airports in Blythe, California, 48 mi (77 km) west, and the
34 Parker (Avi Suquilla) airport, 38 mi (61 km) northwest of the SEZ, are too far away to be
35 affected by developments in the SEZ.

36 37 38 **8.1.22.4.6 Soil Resources**

39
40 Ground-disturbing activities (e.g., grading, excavating, and drilling) during the
41 construction phase of a solar project, including the construction of any associated transmission
42 line connections and new roads, would contribute to soil loss due to wind erosion. Road use
43 during construction, operations, and decommissioning of the solar facilities would further
44 contribute to soil loss. Programmatic design features would be employed to minimize erosion
45 and loss. Residual soil losses with mitigations in place would be in addition to losses from
46 construction of other potential solar energy facilities and other ongoing activities, including

1 OHV use. Cumulative impacts on soil resources from other foreseeable projects within the
2 geographic extent of effects are possible. Potential new solar facilities outside the SEZ would
3 contribute incremental impacts on soil erosion, the extent of which would depend on the number
4 and location of facilities actually built. Cumulative impacts, including from any development in
5 the SEZ, would be small with mitigations in place.
6

7 Landscaping of solar energy facility areas in the SEZ could alter drainage patterns and
8 lead to increased siltation of surface water streambeds, in addition to that from other potential
9 solar projects and other activities outside the SEZ. However, with the required programmatic
10 design features in place, cumulative impacts would likewise be small.
11

12 **8.1.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)**

13 As discussed in Section 8.1.8, there are currently no active oil and gas leases within the
14 proposed Brenda SEZ, and there are no mining claims or proposals for geothermal energy
15 development pending. Because of the generally low level of mineral production in the proposed
16 SEZ and surrounding area and the expected low impact on mineral accessibility of other
17 foreseeable actions within the geographic extent of effects, no cumulative impacts on mineral
18 resources are expected. It bears noting, however, that the proposed reopening of the Copperstone
19 Mine 9.5 mi (15 km) north of Quartzite is in a location on or near pending solar applications
20 (Figure 8.1.22.2-1), so potential impacts on mining appear possible in the region.
21
22
23

24 **8.1.22.4.8 Water Resources**

25 Section 8.1.9.2 describes the water requirements for various technologies if they were to
26 be employed on the proposed SEZ to develop utility-scale solar energy facilities. The amount of
27 water needed during the peak construction year for all evaluated solar technologies would be
28 1,387 to 2,014 ac-ft (1.7 million to 2.5 million m³). During operations, with full development of
29 the SEZ over 80% of its available land area, the amount of water needed for all evaluated solar
30 technologies would range from 18 to 9,316 ac-ft/yr (22,000 to 11 million m³/yr). The amount of
31 water needed during decommissioning would be similar to or less than the amount used during
32 construction. As discussed in Section 8.1.22.3.3, water withdrawals in 2005 from surface waters
33 and groundwater in La Paz County were 704,009 ac-ft/yr (86 million m³/yr), of which 87% came
34 from surface waters and 13% came from groundwater. The largest water use category was
35 irrigation, at 698,886 ac-ft/yr (862 million m³/yr). Therefore, cumulatively the additional water
36 resources needed for solar facilities in the SEZ during operations would constitute from a
37 relatively very small (0.003%) to a small (1.3%) increment (the ratio of the annual water
38 requirement for operations to the annual amount withdrawn in La Paz County), depending on the
39 solar technology used (PV technology at the low end and the wet-cooled parabolic trough
40 technology at the high end). As discussed in Section 8.1.9.1.3, since 1991, groundwater
41 withdrawals from the Ranegras Plain basin, where the proposed SEZ is located, have hovered
42 around 30,000 ac-ft/yr (37 million m³/yr), a level that far exceeds estimates of natural recharge,
43 which range from less than 1,000 ac-ft/yr (1.2 million m³/yr) to more than 6,000 ac-ft/yr
44 (7.4 million m³/yr) (Section 8.1.9.2). Thus, solar developments on the SEZ would have the
45
46

1 capacity to exceed even the upper end of estimates of basin recharge using wet-cooling, while
2 full development with dry-cooled solar trough technologies could require up to 940 ac-ft/yr
3 (1.2 million m³/yr) (Section 8.1.9.2.2), or from 15% to approximately 100% of estimated
4 recharge in the basin (Section 8.1.9.2.2).

5
6 While solar development of the proposed SEZ with water-intensive technologies would
7 likely be judged infeasible due to already strained groundwater supplies, if employed, intensive
8 groundwater withdrawals could affect groundwater flow patterns, cause drawdown of
9 groundwater, modify natural drainage pathways and recharge zones, cause land subsidence, and
10 affect ecological habitats in the Ranegras Plain basin (Section 8.1.9.2). Cumulative impacts on
11 groundwater could occur when combined with other future developments in the region. The
12 proposed fast-track Solar Millennium Blythe Solar Energy Project would be located about 45 mi
13 (72 km) west of the SEZ on the other side of the Colorado River in the proposed Riverside East
14 SEZ in California and would use dry cooling. Thus, this project would not likely contribute to
15 groundwater impacts in the Ranegras Plain basin. However, it would be expected that some
16 number of the other 28 pending solar applications within 50 mi (80 km) of the proposed SEZ
17 (Section 8.1.22.2.1) will ultimately be built and that some of these projects could contribute to
18 cumulative effects on groundwater supplies and surface ecological habitats from water use, soil
19 erosion, and drainage effects.

20
21 Small quantities of sanitary wastewater would be generated during the construction and
22 operation of the potential utility-scale solar energy facilities. The amount generated from solar
23 facilities would be in the range of 9 to 74 ac-ft (11,000 to 91,000 m³) during the peak
24 construction year and would range from 0.4 to 9 ac-ft/yr (up to 11,000 m³/yr) during operations.
25 Because of the small quantity, the sanitary wastewater generated by the solar energy facilities
26 would not be expected to put undue strain on available sanitary wastewater treatment facilities
27 in the general area of the SEZ. For technologies that rely on conventional wet-cooling systems,
28 there would also be 98 to 176 ac-ft/yr (120,000 to 220,000 m³/yr) of blowdown water from
29 cooling towers. Blowdown water would need to be either treated on-site or sent to an off-site
30 facility. Any on-site treatment of wastewater would have to ensure that treatment ponds are
31 effectively lined in order to prevent any groundwater contamination. Thus, blowdown water
32 would not contribute to cumulative effects on treatment systems or on groundwater.

33 34 35 **8.1.22.4.9 Vegetation**

36
37 The proposed Brenda SEZ is located within the Sonoran Basin and Range ecoregion,
38 which supports creosotebush-bursage plant communities with large areas of palo verde-cactus
39 shrub and saguaro cactus communities. Lands within the SEZ are classified primarily as Sonora–
40 Mojave Creosotebush–White Bursage Desert Scrub. Sensitive habitats on the SEZ include desert
41 dry wash woodlands and desert chenopod scrub/mixed salt desert scrub. In the 5-mi (8-km)
42 area of indirect effects, the predominant cover types are Sonora–Mojave Creosotebush–White
43 Bursage Desert Scrub and Sonoran–Paloverde Mixed Cacti Desert Scrub (Section 8.1.10.1). If
44 utility-scale solar energy projects were to be constructed within the SEZ, all vegetation within
45 the footprints of the facilities would likely be removed during land-clearing and land-grading
46 operations. Full development of the SEZ over 80% of its area would result in small impacts on

1 all cover types (Section 8.1.10.2.1). Intermittently flooded areas downgradient from solar
2 projects or access roads could be affected by ground-disturbing activities. Alteration of surface
3 drainage patterns or hydrology could adversely affect downstream dry wash communities,
4 including woodlands and chenopod scrub habitats. In addition, mesquite bosque communities
5 that depend on accessible groundwater could be affected by lowered groundwater levels if solar
6 projects were to draw heavily on this resource.

7
8 The fugitive dust generated during the construction of the solar facilities could increase
9 the dust loading in habitats outside a solar project area, in combination with that from other
10 construction, mining, agriculture, recreation, and transportation activities. The cumulative
11 dust loading could result in reduced productivity or changes in plant community composition.
12 Similarly, surface runoff from project areas after heavy rains could increase sedimentation and
13 siltation in areas downstream. Implementation of programmatic design features would reduce the
14 impacts from solar energy projects and thus reduce the overall cumulative impacts on plant
15 communities and habitats.

16
17 While most of the cover types within the SEZ are relatively common in the SEZ region,
18 Sonoran–Mojave Mixed Salt Desert Scrub is relatively uncommon, representing 0.2 % of the
19 land area within the region. Thus, other ongoing and reasonably foreseeable future actions could
20 have a cumulative effect on this and other rare cover types, as well as on more abundant species.
21 Such effects would likely be small for foreseeable development due to the abundance of the
22 primary species and the relatively small number of foreseeable actions within the geographic
23 extent of effects. However, given the large number of pending solar applications within this
24 area and the large acreages potentially disturbed (Section 8.1.22.2.1), depending on where any
25 eventual projects are located, up to moderate cumulative effects on some rare cover types are
26 possible. In addition, cumulative effects on wetland species could occur from water use, drainage
27 modifications, and stream sedimentation from these and any other potential future developments
28 in the region. The magnitude of such effects is difficult to predict at the current time.

30 31 ***8.1.22.4.10 Wildlife and Aquatic Biota***

32
33 Wildlife species that could potentially be affected by the development of utility-scale
34 solar energy facilities in the proposed Brenda SEZ include amphibians, reptiles, birds, and
35 mammals. The construction of utility-scale solar energy projects in the SEZ and any associated
36 transmission lines and roads in or near the SEZ would have an impact on wildlife through habitat
37 disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, loss of
38 connectivity between natural areas, and wildlife injury or mortality. In general, species with
39 broad distributions and a variety of habitats would be less affected than species with a narrowly
40 defined habitat within a restricted area. The required design features would reduce the severity of
41 impacts on wildlife. The design features include pre-disturbance biological surveys to identify
42 key habitat areas used by wildlife, followed by avoidance or minimization of disturbance to
43 those habitats.

44
45 As noted in Section 8.1.22.2, other ongoing, reasonably foreseeable and potential future
46 actions within 50 mi (80 km) of the proposed SEZ include one fast-track solar application and

1 28 other pending solar development applications (Figure 8.1.22.2-1). Impacts from full build-out
2 over 80% of the proposed SEZ would result in small impacts on amphibian, reptile, bird, and
3 mammal species (Section 8.1.11), while impacts from foreseeable development within the 50-mi
4 (80-km) geographic extent of effects would likewise be small. Many of the wildlife species
5 present within the proposed SEZ that could be affected by other actions have extensive available
6 habitat within the region, while only one foreseeable solar project and no other major foreseeable
7 projects have been identified within the geographic extent of effects. However, given the fact
8 that there are as many as 28 other pending solar applications in the region, cumulative effects on
9 some species could rise to a level of moderate, given the large acreages potentially disturbed and
10 depending on the number and location of projects actually built.

11
12 There are no surface water bodies or perennial streams, seeps, springs, or wetlands
13 within the proposed Brenda SEZ or within the 5-mi (8-km) area of indirect effects. Bouse
14 wash, an intermittent wash, runs through the eastern edge of the SEZ. This and other ephemeral
15 washes in the SEZ are typically dry and flow only after precipitation. Thus, no standing aquatic
16 communities are likely to be present in the proposed SEZ. Aquatic communities do exist within
17 the 50-mi (80-km) geographic extent of effects, including in the Colorado River about 33 mi
18 (53 km) west of the SEZ (Section 8.1.11.2), but these habitats are too far away to be affected by
19 solar development in the SEZ. Thus, there would be no contributions to cumulative impacts on
20 aquatic biota and habitats resulting from groundwater drawdown or soil transport to surface
21 streams from solar facilities within the SEZ.

22 23 24 **8.1.22.4.11 Special Status Species (*Threatened, Endangered, Sensitive,*** 25 ***and Rare Species*)**

26
27 On the basis of recorded occurrences or suitable habitat, as many as 20 special status
28 species could occur within the Brenda SEZ. Of these species, two are known or are likely to
29 occur within the affected area of the SEZ (including the SEZ, the 5-mi [8-km] area of indirect
30 effects, and road and transmission ROWs): desert tortoise (Sonoran population), and California
31 leaf-nosed bat. Section 8.1.12.1 discusses the nature of the special status listing of these two
32 species within state and federal agencies. Numerous additional species that may occur on or in
33 the vicinity of the SEZ are listed as threatened or endangered by the States of Arizona or
34 California or listed as a sensitive species by the BLM (Section 8.1.12.1). Design features to be
35 used to reduce or eliminate the potential for effects on these species from the construction and
36 operation of utility-scale solar energy facilities in the SEZ and related facilities (e.g., access
37 roads and transmission line connections) outside the SEZ include avoidance of habitat and
38 minimization of erosion, sedimentation, and dust deposition. Ongoing effects on special status
39 species include those from roads, transmission lines, and recreational activities in the area. While
40 the amount of foreseeable development within the geographic extent of effects is low, primarily
41 one fast-track solar project 45 mi (72 km) west of the SEZ, as many as 28 pending applications
42 for solar projects within the same 50-mi (80-km) area are pending. Cumulative impacts on
43 protected species are expected to be relatively low, but could rise if a large number of the
44 pending solar applications are actually built. Actual impacts would further depend on the
45 location and cooling technologies of projects that are built. Projects would employ mitigation
46 measures to limit effects.

1 **8.1.22.4.12 Air Quality and Climate**
2

3 While solar energy generates minimal emissions compared with fossil fuels, the site
4 preparation and construction activities associated with solar energy facilities would be
5 responsible for some amount of air pollutants. Most of the emissions would be particulate
6 matter (fugitive dust) and emissions from vehicles and construction equipment. When these
7 emissions are combined with those from other nearby projects outside the proposed Brenda
8 SEZ or when they are added to natural dust generation from winds and windstorms, the air
9 quality in the general vicinity of the projects could be temporarily degraded. For example, the
10 maximum 24-hour PM₁₀ concentration at or near the SEZ boundaries could at times exceed the
11 applicable standard of 150 µg/m³. The dust generation from the construction activities can be
12 controlled by implementing aggressive dust control measures, such as increased watering
13 frequency or road paving or treatment.
14

15 Because the area proposed for the SEZ is rural and undeveloped land, there are no
16 significant industrial sources of air emissions in the area. The only type of air pollutant of
17 concern is dust generated by winds. While there are a number of potential solar projects, as well
18 as the proposed reopening of the Copperstone Mine 18 mi (29 km) northwest of the SEZ,
19 that could produce fugitive dust emissions within the geographic extent of effects, few such
20 projects are likely to overlap significantly in both time and affected area for any projects within
21 the SEZ. Thus, cumulative air quality effects due to dust emissions during any overlapping
22 construction periods would be small.
23

24 Over the long term and across the region, the development of solar energy may have
25 beneficial cumulative impacts on the air quality and atmospheric values by offsetting the need
26 for energy production that results in higher levels of emissions, such as coal, oil, and natural gas.
27 As discussed in Section 8.1.13.2.2, air emissions from operating solar energy facilities are
28 relatively minor, while the displacement of criteria air pollutants, VOCs, TAPs, and GHG
29 emissions currently produced from fossil fuels could be significant. For small SEZs, such offsets
30 are fairly modest. For example, if the Brenda SEZ were fully developed (80% of its acreage)
31 with solar facilities, the quantity of pollutants avoided could be as large as 1.6% of all emissions
32 from the current electric power systems in Arizona.
33
34

35 **8.1.22.4.13 Visual Resources**
36

37 The proposed Brenda SEZ is located the Ranegras Plain, which extends more than 40 mi
38 (64 km) from northwest to the southeast and is about 10 mi (16 km) wide. The SEZ is bounded
39 by mountain ranges on the east, northeast, south, and west (Section 8.1.14.1). The area is
40 sparsely inhabited, remote, and rural in character. Currently, there is a low level of cultural
41 disturbance, including from dirt roads, a corral, a well, and from grazing. Construction of utility-
42 scale solar facilities on the SEZ and associated transmission lines outside the SEZ would
43 significantly alter the natural scenic quality of the area. Other potential solar projects and related
44 roads and transmission lines outside the proposed SEZ would cumulatively affect the visual
45 resources in the area.
46

1 There is currently only one fast-track solar facility application, about 45 mi (72 km)
2 west of the SEZ, and as many as 28 other pending solar applications within 50 mi (80 km) of
3 the SEZ (Figure 8.1.22.2-1). While the contribution to cumulative impacts in the area of
4 foreseeable and potential projects would depend on the location of facilities that are actually
5 built, it may be concluded that the general visual character of the landscape within this distance
6 could be significantly altered by the presence of solar facilities, transmission lines, and other
7 new infrastructure. Because of the topography of the region, such developments, located in basin
8 flats, would be visible at great distances from surrounding mountains, which include sensitive
9 viewsheds. Given the proximity of several of the pending solar applications to the proposed
10 SEZ and to each other, it is possible that two or more facilities would be viewable from a single
11 location. In addition, facilities would be located near major roads and thus would be viewable by
12 motorists, who would also be viewing transmission lines, towns, and other infrastructure, as well
13 as the road system itself.

14
15 As additional facilities are added, several projects might become visible from one
16 location, or in succession, as viewers move through the landscape, as by driving on local roads.
17 In general, the new facilities would be expected to vary in appearance and depending on the
18 number and type of facilities, the resulting visual disharmony could exceed the visual absorption
19 capability of the landscape and add significantly to the cumulative visual impact. Considering
20 the above and the large number of pending solar applications in the region, moderate cumulative
21 visual impacts could occur within the geographic extent of effects from future solar and other
22 existing and future development.

23 24 25 **8.1.22.4.14 Acoustic Environment**

26
27 The areas around the proposed Brenda SEZ are relatively quiet. Existing noise sources
28 around the SEZ include road traffic, railroad traffic, infrequent aircraft flyover, cattle grazing,
29 and occasional community activities and events. The construction of solar energy facilities could
30 increase the noise levels periodically for up to 3 years per facility, but there would be little or
31 minor noise impacts during operation of solar facilities, except from solar dish engine facilities
32 and from parabolic trough or power tower facilities using TES, which could affect nearby
33 residences.

34
35 Other ongoing and reasonably foreseeable and potential future activities in the general
36 vicinity of the SEZ are described in Section 8.1.22.2. Because proposed projects and nearest
37 residents are relatively far from the SEZ with respect to noise impacts and the area is sparsely
38 populated, cumulative noise effects during the construction or operation of solar facilities are
39 unlikely.

40 41 42 **8.1.22.4.15 Paleontological Resources**

43
44 The proposed Brenda SEZ has unknown potential for the occurrence of significant
45 fossil material over its entire extent and requires further investigation prior to project approval
46 (Section 8.1.16.1). Any paleontological resources encountered during a paleontological survey

1 would be mitigated to the extent possible. Cumulative impacts on paleontological resources
2 would be dependent on whether significant resources are found within the SEZ and in additional
3 project areas in the region.
4
5

6 ***8.1.22.4.16 Cultural Resources*** 7

8 The proposed Brenda SEZ is rich in cultural history, with settlements dating as far back
9 as 12,000 years, and has the potential to contain significant cultural resources, both prehistoric
10 and historic, especially in the eastern portion of the SEZ. No surveys have been conducted within
11 the boundaries of the SEZ, but 25 surveys have been conducted within 5 mi (8 km) of the SEZ,
12 resulting in the recording of 37 sites within this range (Section 8.1.17.1.5). It is possible, but
13 unlikely, that the development of utility-scale solar energy projects in the SEZ, when added to
14 other potential projects likely to occur in the area, could contribute cumulatively to cultural
15 resource impacts occurring in the region. The amount of foreseeable development is low within
16 the 25-mi (40-km) geographic extent of effects; however, numerous potential solar projects with
17 pending applications lie within this distance (Section 8.1.22.2). While any future solar projects
18 would disturb large areas, the specific sites selected for future projects would be surveyed;
19 historic properties encountered would be avoided or mitigated to the extent possible. Through
20 ongoing consultation with the Arizona SHPO and appropriate Native American governments, it
21 is likely that most adverse effects on significant resources in the region could be mitigated to
22 some degree. While avoidance of all NRHP-eligible sites and mitigation of all impacts may not
23 be possible, it is unlikely that any sites recorded in the SEZ would be of such individual
24 significance that development would cumulatively cause an irretrievable loss of information
25 about a significant resource type.
26
27

28 ***8.1.22.4.17 Native American Concerns*** 29

30 Government-to-government consultation is under way with federally recognized Native
31 American Tribes with possible traditional ties to the Brenda area, including the Yavapai,
32 Quechan, and Mohave Tribes. All such Tribes have been contacted and provided an opportunity
33 to comment or consult regarding this PEIS. To date, no specific concerns have been raised to
34 the BLM regarding the proposed Brenda SEZ. However, the Quechan Indian Tribe of Fort Yuma
35 have expressed concerns for landscapes as a whole and for the intrusion of industrial
36 development on traditional trails specifically, while game and wild plant resources have been
37 a concern of the Yavapai in the past. Potential impacts on existing water supplies, ecological
38 fragmentation, and land disturbance are also of concern to Tribes (Section 8.1.18). The
39 development of solar energy facilities in combination with the development of other planned and
40 foreseeable projects in the area would likely reduce the traditionally important plant and animal
41 resources available to the Tribes. Such effects would likely be small for foreseeable development
42 due to the abundance of the most culturally important plant species and the relatively small
43 number of foreseeable actions within the geographic extent of effects. Continued discussions
44 with area Tribes through government-to-government consultation is necessary to effectively
45 consider and address the Tribes' concerns tied to solar energy development in the Brenda SEZ.
46

1 **8.1.22.4.18 Socioeconomics**
2

3 Solar energy development projects in the proposed Brenda SEZ could cumulatively
4 contribute to socioeconomic effects in the immediate vicinity of the SEZ and in the surrounding
5 multicounty ROI. The effects could be positive (e.g., creation of jobs and generation of extra
6 income, increased revenues to local governmental organizations through additional taxes paid by
7 the developers and workers) or negative (e.g., added strain on social institutions such as schools,
8 police protection, and health care facilities). Impacts from solar development would be most
9 intense during facility construction, but of greatest duration during operations. Construction
10 would temporarily increase the number of workers in the area needing housing and services in
11 combination with temporary workers involved in other new development in the area, including
12 other renewable energy projects. The number of workers involved in the construction of solar
13 projects (including the transmission line) in the peak construction year could range from about
14 130 to 1,700, depending on the technology being employed, with solar PV facilities at the low
15 end and solar trough facilities at the high end. The total number of jobs created in the area
16 could range from approximately 400 (solar PV) to as high as 5,200 (solar trough). Cumulative
17 socioeconomic effects in the ROI from construction of solar facilities would occur to the extent
18 that multiple construction projects of any type were ongoing at the same time. It is a reasonable
19 expectation that this condition would occur within a 50-mi (80-km) radius of the SEZ
20 occasionally over the 20-year or more solar development period.
21

22 Annual impacts during the operation of solar facilities would be less, but of 20- to
23 30-year duration, and could combine with those from other new developments in the area,
24 including from the fast-track Solar Millennium Blythe Solar Energy Project, which would be
25 45 mi (72 km) east of the proposed SEZ, and from some number of the other 28 pending solar
26 applications within 50 mi (80 km) of the proposed SEZ. Based on the assumption of full build-
27 out of the SEZ (Section 8.1.19.2.2), the number of workers needed at the solar facilities in the
28 SEZ would range from 7 to 130, with approximately 10 to 220 total jobs created in the region.
29 Population increases would contribute to general upward trends in the region in recent years. The
30 socioeconomic impacts overall would be positive, through the creation of additional jobs and
31 income. The negative impacts, including some short-term disruption of rural community quality
32 of life, would not likely be considered large enough to require specific mitigation measures.
33
34

35 **8.1.22.4.19 Environmental Justice**
36

37 Any impacts from solar development could have cumulative impacts on minority and
38 low-income populations within 50 mi (80 km) of the proposed SEZ in combination with other
39 development in the area. Such impacts could be both positive, such as from increased economic
40 activity, and negative, such as from visual impacts, noise, and exposure to fugitive dust
41 (Section 8.1.20.2). Actual impacts would depend on where low-income populations are located
42 relative to solar and other proposed facilities and on the geographic range of effects. Overall,
43 effects from facilities within the SEZ are expected to be small, while other foreseeable and
44 potential actions would not likely combine with negative effects from the SEZ on minority or
45 low-income populations, with the possible exception of visual impacts from solar development

1 in the region. Thus, it is not expected that the proposed Brenda SEZ would contribute to
2 cumulative impacts on minority and low-income populations.
3

4 5 **8.1.22.4.20 Transportation** 6

7 U.S. 60 runs along the southeast border of the proposed Brenda SEZ. The nearest public
8 airports are the Parker and Blythe Airports, which are both approximately a 50-mi (80-km)
9 drive away. The closest rail stop is in Vicksburg, about 11 mi (18 km) east of the SEZ. During
10 construction of utility-scale solar energy facilities, up to 1,000 workers could be commuting to
11 the construction site at the SEZ at a given time, which could increase the AADT on these roads
12 by 2,000 vehicle trips for each facility under construction. Traffic on I-10 or State Route 72
13 could experience minor slowdowns near their junctions with U.S. 60 (Section 8.1.21.2). This
14 increase in highway traffic from construction workers could likewise have small cumulative
15 impacts in combination with existing traffic levels and increases from additional future
16 development in the area, including from construction of potential solar facilities with pending
17 applications in the region, should construction schedules overlap. Local road improvements on
18 portions of U.S. 60 near the SEZ may be necessary. Any impacts during construction activities
19 would be temporary. The impacts can also be mitigated to some degree by staggered work
20 schedules and ride-sharing programs. Traffic increases during operation would be relatively
21 small because of the low number of workers needed to operate the solar facilities and would have
22 little contribution to cumulative impacts.
23
24
25
26

1 **8.1.23 References**

2
3 *Note to Reader:* This list of references identifies Web pages and associated URLs where
4 reference data were obtained for the analyses presented in this PEIS. It is likely that at the time
5 of publication of this PEIS, some of these Web pages may no longer be available or their URL
6 addresses may have changed. The original information has been retained and is available through
7 the Public Information Docket for this PEIS.

8
9 ADEQ (Arizona Department of Environmental Quality), 2009, *2009 Air Quality Annual Report*.
10 Available at http://www.azdeq.gov/function/forms/download/2009_Annual_Report-AQD.pdf.
11 Accessed July 24, 2010.

12
13 ADEQ, 2010, *Water Quality Permits: Stormwater*. Available at <http://www.azdeq.gov/environ/water/permits/stormwater.html>. Accessed July 12, 2010.

14
15
16 ADOT (Arizona Department of Transportation), 2010, *Average Annual Daily Traffic (AADT) AADT Reports (Traffic Counts), Current AADTs, 2006 to 2008*, Multimodal Planning Division.
17 Available at <http://mpd.azdot.gov/mpd/data/aadt.asp>. Accessed July 16, 2010.

18
19
20 ADWR (Arizona Department of Water Resources), 1999, *Section III: Future Conditions and*
21 *Directions*, Third Management Plan for Phoenix Active Management Area 2000-2010,
22 Dec. 1999.

23
24 ADWR, 2010a, *Arizona Water Atlas*. Available at <http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/default.htm>. Accessed July 8, 2010.

25
26
27 ADWR, 2010b, *Ranegras Plain Basin*, Available at http://www.azwater.gov/azdwr/StatewidePlanning/RuralPrograms/OutsideAMAs_PDFs_for_web/Lower_Colorado_River_Planning_Area/Ranegras_Plain_Basin.pdf. Accessed June 24, 2010.

28
29
30
31 ADWR, 2010c, *Overview of the Arizona Groundwater Management Code*. Available at
32 http://www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf.
33 Accessed June 21, 2010.

34
35 ADWR, 2010d, *Land Subsidence in the Ranegras Valley, La Paz County, 06/08/1992 to*
36 *03/13/1997*. Available at http://www.azwater.gov/AzDWR/Hydrology/Geophysics/documents/RanegrasValleyArea1992to1997_8x11.pdf. Accessed May 2010.

37
38
39 ADWR, 2010e, *Land Subsidence in the Ranegras Valley, La Paz County, 02/05/2004 to*
40 *02/18/201*. Available at http://www.azwater.gov/AzDWR/Hydrology/Geophysics/documents/RanegrasValleyArea2008to2010_8x11.pdf. Accessed May 2010.

41
42
43 ADWR, 2010f, *Land Subsidence in Arizona*. Available at <http://www.azwater.gov/AzDWR/Hydrology/Geophysics/LandSubsidenceInArizona.htm>. Accessed May 2010.

1 ADWR, 2010g, *A Practical Guide to Drilling a Well in Arizona*. Available at
2 <http://www.azwater.gov/AzDWR/WaterManagement/Wells/documents/wellguide.pdf>.
3 Accessed July 12, 2010.
4
5 ADWR, 2010h, *Lower Colorado River Hydrology—Groundwater (West Basins)*. Available
6 at [http://www.adwr.state.az.us/azdwr/StatewidePlanning/WaterAtlas/LowerColoradoRiver/
7 PlanningAreaOverview/Hydrology_West_Cont.htm](http://www.adwr.state.az.us/azdwr/StatewidePlanning/WaterAtlas/LowerColoradoRiver/PlanningAreaOverview/Hydrology_West_Cont.htm). Accessed July 23, 2010.
8
9 ADWR, 2010i, *Securing Arizona’s Water Future—Ranegras Plain Basin*. Available at
10 [http://www.azwater.gov/AzDWR/StateWidePlanning/RuralPrograms/OutsideAMAs_PDFs_
11 for_web/default.htm](http://www.azwater.gov/AzDWR/StateWidePlanning/RuralPrograms/OutsideAMAs_PDFs_for_web/default.htm). Accessed July 23, 2010.
12
13 ADWR, 2010j, *About ADWR*, Available at: [http://www.adwr.state.az.us/azdwr/
14 PublicInformationOfficer/About_ADWR.htm](http://www.adwr.state.az.us/azdwr/PublicInformationOfficer/About_ADWR.htm). Accessed June 21, 2010.
15
16 ADWR, 2010k, *Water Management Requirements for Solar Power Plants in Arizona*, Available
17 at: [http://www.azwater.gov/azdwr/WaterManagement/solar/documents/
18 Solar_Regulation_Summary_FINAL.pdf](http://www.azwater.gov/azdwr/WaterManagement/solar/documents/Solar_Regulation_Summary_FINAL.pdf). Accessed June 21, 2010.
19
20 ADWR, 2010l, *Colorado River Management*, Available at: [http://www.azwater.gov/
21 AzDWR/StateWidePlanning/CRM/Overview.htm](http://www.azwater.gov/AzDWR/StateWidePlanning/CRM/Overview.htm). Accessed July 21, 2010.
22
23 ADWR, 2010m, *Active Management Areas (AMAs) & Irrigation Non-expansion Areas (INAs)*,
24 Available at: <http://www.azwater.gov/AzDWR/WaterManagement/AMAs/>. Accessed
25 June 22, 2010.
26
27 AECOM (Architectural Engineering, Consulting, Operations and Maintenance), 2009, *Project
28 Design Refinements*. Available at [http://energy.ca.gov/sitingcases/beacon/documents/applicant/
29 refinements/002_WEST1011185v2_Project_Design_Refinements.pdf](http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf). Accessed Sept. 2009.
30
31 AGS (Arizona Geological Survey), 2010, *Locations of Mapped Earth Fissure Traces in
32 Arizona, Digital Information 39 (DI-39), Ver. 6.22.09*. Available at [http://www.azgs.az.gov/
33 efresources.shtml](http://www.azgs.az.gov/efresources.shtml). Accessed July 22, 2010.
34
35 AMA (American Medical Association), 2009, *Physician Characteristics and Distribution in the
36 U.S.*, Chicago, Ill. Available at <http://www.ama-assn.org/ama/pub/category/2676.html>.
37
38 ANHP (Arizona National Heritage Program), 2010, *Arizona’s Natural Heritage Program:
39 Heritage Data Management System (HDMS)*. Available at [http://www.azgfd.gov/w_c/
40 edits/species_concern.shtml](http://www.azgfd.gov/w_c/edits/species_concern.shtml). Accessed July 20, 2010.
41
42 Arizona Department of Commerce, 2010, *Arizona Population Projections*. Available at
43 <http://www.azcommerce.com/EconInfo/Demographics/Population+Projections.htm>.
44
45 Arizona Field Ornithologists, 2010, *Field Checklist of the Birds of La Paz County*. Available at
46 <http://azfo.org/documents/LaPaz.pdf>. Accessed July 25, 2010.

1 AZDA (Arizona Department of Agriculture), 2010, *Prohibited, Regulated, and Restricted*
2 *Noxious Weeds*, Plant Services Division, Phoenix, Ariz.
3
4 Bailie, A., et al., 2005, *Final Arizona Greenhouse Gas Inventory and Reference Case*
5 *Projections 1990-2020*. Arizona Department of Environmental Quality and Center for Climate
6 Strategies, June. Available at [http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/](http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4)
7 [statepubs&CISOPTR=2347&CISOBOX=1&REC=4](http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4). Accessed July 20, 2010.
8
9 Beacon Solar, LLC, 2008, *Application for Certification for the Beacon Solar Energy Project*,
10 submitted to the California Energy Commission, March. Available at [http://www.energy.ca.gov/](http://www.energy.ca.gov/sitingcases/beacon/index.html)
11 [sitingcases/beacon/index.html](http://www.energy.ca.gov/sitingcases/beacon/index.html).
12
13 Bean, L., et al., 1978, Persistence and Power: A Study of Native American Peoples in the
14 Sonoran Desert and the Devers-Palo Verde High Voltage Transmission Line, prepared for the
15 Southern California Edison Company by Cultural Systems Research, Incorporated, Menlo Park,
16 Calif.
17
18 Bee, R.L., 1983, "Quechan," pp. 86–97 in *Handbook of North American Indians, Vol. 10,*
19 *Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.
20
21 Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control
22 Engineering, Washington, D.C.
23
24 Bischoff, M.C., 2000, *The Desert Training Center/California-Arizona Maneuver Area,*
25 *1942–1944: Historic and Archaeological Contexts*, Technical Series 75, Statistical Research,
26 Inc., Tucson, Ariz., prepared for the Bureau of Land Management, California Desert District.
27
28 BLM (Bureau of Land Management), 1980, *Green River—Hams Fork Draft Environmental*
29 *Impact Statement: Coal*, Denver, Colo.
30
31 BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale*
32 *Leasing Program*, Colorado State Office, Denver, Colo., Jan.
33
34 BLM, 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24,
35 U.S. Department of the Interior.
36
37 BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410-1, Release 8-28,
38 U.S. Department of the Interior, Jan.
39
40 BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30,
41 U.S. Department of the Interior, Jan.
42
43 BLM, 1996, *White River Resource Area Proposed Resource Management Plan and Final*
44 *Environmental Impact Statement*, Colorado State Office, White River Resource Area, Craig
45 District, Colo., June.
46

1 BLM, 2001, *Arizona Water Rights Fact Sheet*. Available at [http://www.blm.gov/nstc/
2 WaterLaws/arizona.html](http://www.blm.gov/nstc/WaterLaws/arizona.html).
3

4 BLM, 2006, *Lake Havasu Field Office Proposed Resource Management Plan and Final
5 Environmental Impact Statement*, Lake Havasu Field Office, Lake Havasu City, Ariz., Sept.
6

7 BLM, 2007a, *Lake Havasu Field Office Record of Decision & Approved Management Plan*,
8 Lake Havasu City, Ariz., May. Available at [http://www.blm.gov/az/st/en/info/nepa/
9 environmental_library/arizona_resource_management/LHFO_ROD_07.html](http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/LHFO_ROD_07.html).
10

11 BLM, 2007b, *Potential Fossil Yield Classification (PFYC) System for Paleontological Resources
12 on Public Lands*, Instruction Memorandum No. 2008-009, with attachments, Washington, D.C.,
13 Oct. 15.
14

15 BLM, 2008a, *Assessment and Mitigation of Potential Impacts to Paleontological Resources*,
16 Instruction Memorandum No. 2009-011, with attachments, Washington, D.C., Oct. 10.
17

18 BLM, 2008b, *Agua Fria National Monument and Bradshaw-Harquahala Planning Area
19 Proposed Resource Management Plans and Final Environmental Impact Statement*, Phoenix
20 District Office, Phoenix, Ariz., June.
21

22 BLM, 2008c, *Special Status Species Management*, BLM Manual 6840, Release 6-125,
23 U.S. Department of the Interior, Dec. 12.
24

25 BLM, 2009, *Rangeland Administration System*. Available at <http://www.blm.gov/ras/index.htm>.
26 Last updated Aug. 24, 2009. Accessed March 14, 2010.
27

28 BLM, 2010a, *Wild Horse and Burro Statistics and Maps*. Available at [http://www.blm.gov/
29 wo/st/en/prog/wild_horse_and_burro/wh_b_information_center/statistics_and_maps/ha_and_
30 hma_data.html](http://www.blm.gov/wo/st/en/prog/wild_horse_and_burro/wh_b_information_center/statistics_and_maps/ha_and_hma_data.html). Accessed June 25, 2010.
31

32 BLM, 2010b, *Sonoran Solar Energy Project: Draft Environmental Impact Statement*. Available
33 at http://www.blm.gov/az/st/en/prog/energy/solar/sonoran_solar/maps/DEIS.html.
34

35 BLM, 2010c, *Yuma Field Office Record of Decision and Approved Resource Management Plan*,
36 Bureau of Land Management, Yuma Field Office, January 2010. Available at [http://www.blm.
37 gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/yuma_rod.html](http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/yuma_rod.html).
38

39 BLM, 2010d, *ROD –ARMP: Bradshaw-Harquahala*, Hassayapa Field Office, Phoenix, Ariz.,
40 April 22.
41

42 BLM, 2010e, *Quartzsite Solar Energy Project*. Available at [http://www.blm.gov/az/st/en/prog/
43 energy/solar/quartzsite_solar_energy.html](http://www.blm.gov/az/st/en/prog/energy/solar/quartzsite_solar_energy.html). Accessed July 21, 2010.
44
45

1 BLM, 2010f, *Proposed Reopening of the Copperstone Mine (Preliminary)*, Environmental
2 Assessment, DOI-BLM-AZ-C020-2010-0015-EA AZA035202, Yuma Field Office, May.
3 Available at [http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/nepa/projects/yuma/
4 10.Par.18412.File.dat/C020-2010-0015-EA-copperstone.pdf](http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/nepa/projects/yuma/10.Par.18412.File.dat/C020-2010-0015-EA-copperstone.pdf). Accessed July 26, 2010.
5
6 BLM, 2010g, *Wild Burro Reduction Cibola-Trigo Herd Management Area*, Decision Record,
7 BLM No. DOI-BLM-AZ-C020-2010-0012EA, Yuma Field Office, July. Available at
8 [http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/nepa/projects/yuma/10.Par.1887.File.dat/
9 C020-2010-0012-EA_DR_FONSI.pdf](http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/nepa/projects/yuma/10.Par.1887.File.dat/C020-2010-0012-EA_DR_FONSI.pdf). Accessed: July 26, 2010.
10
11 BLM, 2010h, *Solar Energy Interim Rental Policy*, U.S. Department of the Interior. Available at
12 [http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national
13 instruction/2010/IM_2010-141.html](http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-141.html).
14
15 BLM and CEC (California Energy Commission), 2010, *Staff Assessment and Draft EIS, Blythe
16 Solar Power Project*, 20 CEC-700-2010-004.
17
18 BLM and USFS, 2010a, *GeoCommunicator: Mining Claim Map*. Available at
19 <http://www.geocommunicator.gov/GeoComm/index.shtm>. Accessed June 21, 2010.
20
21 BLM and USFS, 2010b, *GeoCommunicator: Energy Map*. Available at
22 <http://www.geocommunicator.gov/GeoComm/index.shtm>. Accessed June 21, 2010.
23
24 Brennan, T.C., 2008, *Online Field Guide to the Reptiles and Amphibians of Arizona*. Available at
25 <http://www.reptilesfaz.org/index.html>. Accessed July 16, 2010.
26
27 California Department of Finance, 2010, *Population Projections by Race and Ethnicity for
28 California and Its Counties, 2000–2050*. Available at [http://www.dof.ca.gov/research/
29 demographic/reports/projections/p-1/documents/P-1%20Report%20Tables.xls](http://www.dof.ca.gov/research/demographic/reports/projections/p-1/documents/P-1%20Report%20Tables.xls).
30
31 CalPIF (California Partners in Flight), 2009, *The Desert Bird Conservation Plan: A Strategy
32 for Protecting and Managing Desert Habitats and Associated Birds in California*, Ver. 1.0.
33 Available at <http://www.prbo.org/calpif/plans.html>. Accessed March 3, 2010.
34
35 CAP (Central Arizona Project), 2010, *Central Arizona Project*, Available at: [http://www.cap-
36 az.com/](http://www.cap-az.com/). Accessed July 15, 2010.
37
38 CDC (Centers for Disease Control and Prevention), 2009, *Divorce Rates by State: 1990, 1995,
39 1999–2007*. Available at [http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095
40 %20and%2099-07.pdf](http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf).
41
42 CDFG (California Department of Fish and Game), 2008, *Life History Accounts and Range
43 Maps—California Wildlife Habitat Relationships System*, California Department of Fish and
44 Game, Sacramento, Calif. Available at <http://dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx>.
45 Accessed Feb. 19, 2010.
46

1 CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance under the*
2 *National Environmental Policy Act*, Executive Office of the President, Washington, D.C., Dec.
3 Available at <http://ceq.hss.doe.gov/nepa/regs/ej/justice.pdf>.
4

5 Chase, M.K., and G.R. Geupel, 2005, “The Use of Avian Focal Species for Conservation
6 Planning in California,” pp. 130–142 in *Bird Conservation Implementation and Integration in the*
7 *Americas: Proceedings of the Third International Partners in Flight Conference*. March 20–24,
8 2002, Asilomar, Calif., Vol. 1, Gen. Tech. Rep. PSW-GTR-191, C.J. Ralph and T.D. Rich
9 (editors), U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station,
10 Albany, Calif.
11

12 Confederation of American Indians, 1986, *Indian Reservations: A State and Federal Handbook*,
13 McFarland, Jefferson, N.C.
14

15 Cowherd, C., et al., 1988, *Control of Open Fugitive Dust Sources*, EPA 450/3-88-008,
16 U.S. Environmental Protection Agency, Research Triangle Park, N.C.
17

18 CSC (Coastal Services Center), 2010, *Historical Hurricane Tracks*, National Oceanic and
19 Atmospheric Administration. Available at <http://csc-s-maps-q.csc.noaa.gov/hurricanes/>. Accessed
20 July 20, 2010.
21

22 CSRI (Cultural Systems Research, Incorporated), 2002, *The Native Americans of Joshua Tree*
23 *National Park: An Ethnographic Overview and Assessment Study*, prepared for the National Park
24 Service by Cultural Systems Research, Inc., Menlo Park, Calif.
25

26 Desert Tortoise Council, 1994 (Revised 1999), *Guidelines for Handling Desert Tortoises during*
27 *Construction Projects*, E.L. LaRue, Jr. (editor), Wrightwood, Calif.
28

29 DOE (U.S. Department of Energy), 2009, Report to Congress, Concentrating Solar Power
30 Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power
31 Electricity Generation, Jan. 13.
32

33 DSIRE (Database of State Incentives for Renewables & Efficiency), 2010, *Arizona*
34 *Incentives/Policies for Renewables & Efficiency*, U.S. Department of Energy, North Carolina
35 Solar Center, North Carolina State University. Available at [http://www.dsireusa.org/](http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ03R&re=1&ee=1)
36 [incentives/incentive.cfm?Incentive_Code=AZ03R&re=1&ee=1](http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ03R&re=1&ee=1). Accessed: July 14, 2010.
37

38 DuBois, S.M., and A.W. Smith, 1980, “Earthquakes Causing Damage in Arizona,” in *Fieldnotes*,
39 Arizona Bureau of Geology and Mineral Technology, Sept.
40

41 Eldred, K.M., 1982, “Standards and Criteria for Noise Control—An Overview,” *Noise Control*
42 *Engineering* 18(1):16–23.
43

44 EIA (Energy Information Administration), 2009, *Annual Energy Outlook 2009 with Projections*
45 *to 2030*, DOE/EIA-0383, March.
46

1 EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental*
2 *Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*,
3 EPA-550/9-74-004, Washington, D.C., March. Available at [http://www.nonoise.org/library/](http://www.nonoise.org/library/levels74/levels74.htm)
4 [levels74/levels74.htm](http://www.nonoise.org/library/levels74/levels74.htm). Accessed Nov. 17, 2008.
5
6 EPA, 2002, *Primary Distinguishing Characteristics of Level III Ecoregions of the Continental*
7 *United States, Draft*. Available at http://www.epa.gov/wed/ecoregions/us/useco_desc.doc.
8 Accessed Oct. 2, 2008.
9
10 EPA, 2007, *Level III Ecoregions*, Western Ecology Division, Corvallis, Ore. Available at
11 http://www.epa.gov/wed/pages/ecoregions/level_iii.htm. Accessed Oct. 2, 2008.
12
13 EPA, 2009a, *Energy CO₂ Emissions by State*. Available at [http://www.epa.gov/climatechange/](http://www.epa.gov/climatechange/emissions/state_energyc2inv.html)
14 [emissions/state_energyc2inv.html](http://www.epa.gov/climatechange/emissions/state_energyc2inv.html), last updated June 12, 2009. Accessed June 23, 2008.
15
16 EPA, 2009b, *Preferred/Recommended Models—AERMOD Modeling System*. Available at
17 http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed Nov. 8, 2009.
18
19 EPA, 2009c, *eGRID*. Available at [http://www.epa.gov/cleanenergy/energy-resources/egrid/](http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html)
20 [index.html](http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html), last updated Oct. 16, 2008. Accessed Jan. 12, 2009.
21
22 EPA, 2009d, National Primary Drinking Water Regulations and National Secondary Drinking
23 Water Regulation. Available at <http://www.epa.gov/safewater/standard/index.html>.
24
25 EPA, 2010a, *National Ambient Air Quality Standards (NAAQS)*. Available at [http://www.epa.](http://www.epa.gov/air/criteria.html)
26 [gov/air/criteria.html](http://www.epa.gov/air/criteria.html), last updated June 3, 2010. Accessed June 4, 2010.
27
28 EPA, 2010b, *AirData: Access to Air Pollution Data*. Available at <http://www.epa.gov/oar/data/>.
29 Accessed July 20, 2010.
30
31 FAA (Federal Aviation Administration), 2010, *Airport Data (5010) & Contact Information,*
32 *Information Current as of 06/03/2010*. Available at [http://www.faa.gov/airports/airport_safety/](http://www.faa.gov/airports/airport_safety/airportdata_5010/)
33 [airportdata_5010/](http://www.faa.gov/airports/airport_safety/airportdata_5010/). Accessed July 19, 2010.
34
35 Farish, T.E., 1915, *History of Arizona*, Filmer Brothers Electrotpe Company, San Francisco,
36 Calif.
37
38 Fellows, L.D., 2000, “Volcanism in Arizona,” in *Arizona Geology*, Arizona Geological Survey,
39 Vol. 30, No. 4, Winter. Available at http://www.azgs.gov/hazards_volcanoes.shtml. Accessed
40 July 22, 2010.
41
42 FEMA (Federal Emergency Management Agency), 2009, *FEMA Map Service Center*.
43 Available at [http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=](http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1)
44 [10001&catalogId=10001&langId=-1](http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1). Accessed Nov. 20, 2009.
45

- 1 Field, K.J., et al., 2007, “Return to the Wild: Translocation as a Tool in Conservation of the
2 Desert Tortoise (*Gopherus agassizii*),” *Biological Conservation* 136:232-245.
3
- 4 Fire Departments Network, 2009, *Fire Departments by State*. Available at
5 <http://www.firedepartments.net>.
6
- 7 Fort McDowell Yavapai Nation, 2010, *History and Culture*, Fort McDowell, Ariz. Available at
8 <http://www.ftmcdowell.org/history&culture/historyculture2.htm>. Accessed July 19, 2010.
9
- 10 Freethy, G.W., and T.W. Anderson, 1986, Predevelopment Hydrologic Conditions in the
11 Alluvial Basins of Arizona and Adjacent Parts of California and New Mexico, USGS Hydrologic
12 Investigations Atlas HA-664.
13
- 14 Fugro National, Inc., 1979, *MX Siting Investigation Geotechnical Summary – Prime*
15 *Characterization Sites, Sonoran, Candidate Siting Province*, prepared for Space and Missile
16 Systems Organization (SAMSO), Norton Air Force Base, Calif., Feb. 15.
17
- 18 Galloway, D., et al., 1999, *Land Subsidence in the United States*, U.S. Geological Survey
19 Circular 1182.
20
- 21 GCRP (U.S. Global Climate Research Program), 2009, *Global Climate Change Impacts in the*
22 *United States: A State of Knowledge Report from the U.S. Global Change Research Program*,
23 Cambridge University Press, Cambridge, Mass. Available at [http://downloads.globalchange.gov/](http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf)
24 [usimpacts/pdfs/climate-impacts-report.pdf](http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf). Accessed Jan. 25, 2010.
25
- 26 Giffen, R., 2009, “Rangeland Management Web Mail,” personal communication from R. Giffen
27 (USDA Forest Service, Rangelands Management, Washington, D.C.) to W. Vinikour (Argonne
28 National Laboratory, Argonne, Ill.), Sept. 22.
29
- 30 Gifford, E.W., 1932, *The Southeastern Yavapai*, University of California Publications in
31 American Archaeology and Anthropology 29(4):177–252, University of California Press,
32 Berkeley, Calif.
33
- 34 Gifford, E.W., 1936, *The Northeastern and Western Yavapai*, University of California
35 Publications in American Archaeology and Anthropology 34:247-354, University of California
36 Press, Berkeley, Calif.
37
- 38 Hanson, C.E., et al., 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-
39 06, prepared for U.S. Department of Transportation, Federal Transit Administration,
40 Washington, D.C., by Harris Miller Miller & Hanson Inc., Burlington, Mass. May. Available at
41 http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.
42
- 43 Harwell, H.O., and M.C.S. Kelly, 1983, “Maricopa” pp. 71–85 in *Handbook of North American*
44 *Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.
45
- 46 Hoffmeister, D.F., 1986, *Mammals of Arizona*, University of Arizona Press, Tucson, Ariz.

1 ICC (Indian Claims Commission), 1958, “Opinions of Commissioners: Separate Opinion of
2 Chief Commissioner Witt, Jan 28,” *Decisions of the Indian Claims Commission, Vol. 6*,
3 Oklahoma State University. Available at <http://digital.library.okstate.edu/icc/index.html>.
4

5 Ivakhiv, A.J., 2001, *Claiming Sacred Ground: Pilgrims and Politics at Glastonbury and Sedona*,
6 Indiana University Press, Bloomington, Ind.
7

8 Jackson, M., Sr., 2009, “Quechan Indian Tribe’s Comments on Programmatic Environmental
9 Impact Statement for Solar Energy Development,” letter from Jackson (President, Quechan
10 Indian Tribe, Fort Yuma, Ariz.) to Argonne National Laboratory (Argonne, Ill.), Sept. 3.
11

12 Johnson, 1990, *Depth to Water and Altitude of the Water Level, Change in Water Level, and*
13 *Chemical Quality of Water*, ADWR Hydrologic Map Series, Report No. 18, prepared in
14 cooperation with the U.S. Geological Survey.
15

16 Kenny, J. F., et al., 2009, *Estimated Use of Water in the United States in 2005*, U.S. Geological
17 Survey, Circular 1344. Available at <http://pubs.usgs.gov/circ/1344>, county data accessed Jan. 4,
18 2010.
19

20 Kessell, J.L., 2002, *Spain in the Southwest*, University of Oklahoma Press, Norman, Okla.
21

22 Khera, S., and P.S. Mariella, 1983, “Yavapai,” pp. 38–54 in *Handbook of North American*
23 *Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.
24

25 Knack, M., 1981, “Ethnography,” pp. 55–82 in *A Cultural Resources Overview of the Colorado*
26 *Desert Planning Units*, E.W. Ritter (editor), U.S. Bureau of Land Management, California
27 Desert District, Riverside, Calif.
28

29 Kroeber, A.L., 1925, *Handbook of the California Indians*, Bureau of American Ethnology
30 Bulletin 78, Smithsonian Institution, Washington, D.C.
31

32 Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*,
33 Bonneville Power Administration, Portland, Ore., Dec.
34

35 Levick, L., et al., 2008, *The Ecological and Hydrological Significance of Ephemeral and*
36 *Intermittent Streams in the Arid and Semi-arid American Southwest*, U.S. Environmental
37 Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134,
38 ARS/233046.
39

40 Lovich, J., and D. Bainbridge, 1999, “Anthropogenic Degradation of the Southern California
41 Desert Ecosystem and Prospects for Natural Recovery and Restoration,” *Environmental*
42 *Management* 24(3):309–326.
43
44

1 Ludington, S. et al., 2007, *Preliminary Integrated Geologic Map Databases for the United States*
2 – *Western States: California, Nevada, Arizona, Washington, Oregon, Idaho, and Utah*,
3 U.S. Geological Survey Open File Report 2005-1305, Version 1.3, original file updated in Dec.
4 2007. Available at: <http://pubs.usgs.gov/of/2005/1305/index.htm>.
5

6 Lunden, R.F., and C.F. Royse, 1973, “A Late Pleistocene Vertebrate Fauna from the Nichols
7 Site, Scottsdale, Arizona,” *Journal of the Arizona Academy of Science* 8(1):29–33.
8

9 Lynch, D.J., 1982, “Volcanic Processes in Arizona,” in *Fieldnotes*, Arizona Bureau of Geology
10 and Mineral Technology, Vol. 12, No. 3, Sept. Available at [http://www.azgs.az.gov/](http://www.azgs.az.gov/hazards_volcanoes.shtml)
11 [hazards_volcanoes.shtml](http://www.azgs.az.gov/hazards_volcanoes.shtml). Accessed July 22, 2010.
12

13 Mancini, K.M., et al., 1988, *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and*
14 *Wildlife: A Literature Synthesis*, NERC-88/29, U.S. Fish and Wildlife Service National Ecology
15 Research Center, Ft. Collins, Colo.
16

17 Mariella, P., and S. Khera, 1984a, “The Yavapai at Fort McDowell,” p. 166 in *Spirit Mountain:*
18 *An Anthology of Yuman Story and Song*, L. Hinton and L.J. Watahomigie (editors), Sun Tracks
19 and the University of Arizona Press, Tucson, Ariz.
20

21 Mariella, P., and S. Khera, 1984b, “The Yavapai at Camp Verde, Middle Verde, and Clarkdale,”
22 p. 167 in *Spirit Mountain: An Anthology of Yuman Story and Song*, L. Hinton and
23 L.J. Watahomigie (editors), Sun Tracks and the University of Arizona Press, Tucson, Ariz.
24

25 Martin, P.S., and F. Plog, 1973, *The Archaeology of Arizona: a Study of the Southwest Region*,
26 Doubleday/Natural History Press, Garden City, N.Y.
27

28 Matson, R.G., 1991, *The Origins of Southwest Agriculture*, University of Arizona Press, Tucson,
29 Ariz.
30

31 McGuire, R., and M. Schiffer, 1982, *Hohokam and Patayan: Prehistory of Southwestern*
32 *Arizona*, Academic Press, New York, N.Y.
33

34 Metzger, D.G., 1951, *Geology and Ground-Water Resources of the Northern Part of the*
35 *Ranegras Plain Area, Yuma County, Arizona*, U.S. Geological Survey Open File Report 51-28.
36

37 MIG (Minnesota IMPLAN Group), Inc., 2010, *State Data Files*, Stillwater, Minn.
38

39 Miller, N.P., 2002, “Transportation Noise and Recreational Lands,” in *Proceedings of Inter-*
40 *Noise 2002*, Dearborn, Mich., Aug. 19–21. Available at [http://www.hmmh.com/cmsdocuments/](http://www.hmmh.com/cmsdocuments/N011.pdf)
41 [N011.pdf](http://www.hmmh.com/cmsdocuments/N011.pdf). Accessed Aug. 30, 2007.
42

43 Mitchell, V., 1984, “The Yavapai” p. 165 in *Spirit Mountain: An Anthology of Yuman Story and*
44 *Song*, L. Hinton and L.J. Watahomigie (editors), Sun Tracks and the University of Arizona Press,
45 Tucson, Ariz.
46

1 Morgan, G.S., and R.S. White, Jr., 2005, "Miocene and Pliocene Vertebrates from Arizona,"
2 pp 114-135 in *Vertebrate Paleontology in Arizona*, Heckert, A.B., and S.G. Lucas (editors),
3 New Mexico Museum of Natural History and Science Bulletin No. 29.
4

5 National Research Council, 1996, *Alluvial Fan Flooding*, Committee on Alluvial Fan Flooding,
6 Water Science and Technology Board, and Commission on Geosciences, Environment, and
7 Resources, National Academy Press, Washington, D.C.
8

9 NatureServe, 2010, *NatureServe Explorer: An Online Encyclopedia of Life* [Web application],
10 Version 7.1, NatureServe, Arlington, Va. Available <http://www.natureserve.org/explorer>.
11 Accessed Oct. 1, 2010.
12

13 NCDC (National Climatic Data Center), 2010a, *Climates of the States (CLIM60): Climate of*
14 *Arizona*, National Oceanic and Atmospheric Administration, Satellite and Information Service.
15 Available at <http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl>. Accessed
16 July 10, 2010.
17

18 NCDC, 2010b, *Integrated Surface Data (ISD), DS3505 Format*, database, Asheville, N.C.
19 Available at <ftp://ftp3.ncdc.noaa.gov/pub/data/noaa>. Accessed July 11, 2010.
20

21 NCDC, 2010c, *Storm Events*, National Oceanic and Atmospheric Administration, Satellite and
22 Information Service. Available at [http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent](http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms)
23 [~Storms](http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms). Accessed July 20, 2010.
24

25 NCES (National Center for Education Statistics), 2009, *Search for Public School Districts*,
26 U.S. Department of Education. Available at <http://www.nces.ed.gov/ccd/districtsearch>.
27

28 Neusius, S.W., and G.T. Gross, 2007, "Mobility, Flexibility, and Persistence in the Great Basin,"
29 in *Seeking Our Past*, Oxford University Press, New York, N.Y.
30

31 NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO)*
32 *Database for La Paz County, Colorado*. Available at <http://SoilDataMart.nrcs.usds.gov>.
33

34 NRCS, 2010a, *Official Soil Series Descriptions*, USDA-NRCS, Lincoln, Neb. Available at
35 <http://soils.usda.gov/technical/classification/osd/index.html>. Accessed July 22, 2010.
36

37 NRCS, 2010b, *Custom Soil Resource Report for La Paz County (covering the proposed Brenda*
38 *SEZ), Colorado*, U.S. Department of Agriculture, Washington, D.C., Oct. 7.
39

40 NROSL (Northwest Regional Obsidian Sourcing Laboratory), 2009, *Nevada Obsidian Sources*.
41 Available at http://www.obsidianlab.com/image_maps/map_obsidian_arizona.jpg.
42

43 Nussear, K.E., et al., 2009, *Modeling Habitat for the Desert Tortoise (Gopherus agassizii) in*
44 *the Mojave and Parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona*,
45 U.S. Geological Survey Open-File Report 2009-1102.
46

1 RailAmerica, 2010, *Arizona and California Railroad*. Available at <http://www.railamerica.com/RailServices/ARZC.aspx>. Accessed Feb. 26, 2010.

3

4 Reid, J., and S. Whittlesey, 1997, *The Archaeology of Ancient Arizona*, University of Arizona Press, Tucson, Ariz.

6

7 Richard, S.M., et al., 2000, *Geologic Map of Arizona (Scale 1:1,000,000)*, Arizona Geological Survey Map M-35. Available at: http://www.azgs.state.az.us/services_azgeomapve.shtml. Accessed Oct. 20, 2010.

10

11 Robson, S.G., and E.R. Banta, 1995, *Ground Water Atlas of the United States: Arizona, Colorado, New Mexico, Utah*, U.S. Geological Survey, HA 730-C.

13

14 Royster, J., 2008, "Indian Land Claims," pp. 28–37 in *Handbook of North American Indians, Vol. 2, Indians in Contemporary Society*, G.A. Bailey (editor), Smithsonian Institution, Washington, D.C.

17

18 SAMHSA (Substance Abuse and Mental Health Services Administration), 2009, *National Survey on Drug Use and Health, 2004, 2005 and 2006*, Office of Applied Studies, U.S. Department of Health and Human Services. Available at <http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage>.

22

23 Schwartz, S., 2009, "Arizona TES Data Request," personal communication with attachment from Schwartz (HDMS Program Supervisor, Arizona Game and Fish Department, Phoenix, Ariz.) to L. Walston (Argonne National Laboratory, Argonne, Ill.), July 29.

26

27 SES (Stirling Energy Systems) Solar Two, LLC, 2008, "Application for Certification," submitted to the Bureau of Land Management, El Centro, Calif., and the California Energy Commission, Sacramento, Calif., June. Available at <http://www.energy.ca.gov/sitingcases/solartwo/documents/applicant/afc/index.php>. Accessed Oct. 1, 2008.

31

32 Sheridan, T.E., 1995, *Arizona: A History*, University of Arizona Press, Tucson, Ariz.

33

34 Shipman, T.C., and M. Diaz, 2008, *Arizona's Earth Fissure Mapping Program: Protocols, Procedures, and Products*, Arizona Geological Survey Open File Report 08-03.

36

37 Smith, M.D., et al., 2001, "Growth, Decline, Stability and Disruption: A Longitudinal Analysis of Social Well-Being in Four Western Communities," *Rural Sociology* 66:425–450.

39

40 Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians*, Houghton Mifflin Company, Boston and New York.

42

43 Stewart, K.M., 1983, "Mohave," pp. 55–70 in *Handbook of North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.

44

45

1 Stoffle, R.W., et al., 1990, *Native American Cultural Resource Studies at Yucca Mountain,*
2 *Nevada*, University of Michigan, Ann Arbor, Mich.
3

4 Stone, C.L., 1982, “Historical Overview of Central Western Arizona: Non-aboriginal Use of the
5 Desert,” in *Granite Reef, A Study in Desert Archaeology*, Brown, P.E., and C.L. Stone (editors),
6 Anthropological Research Paper No. 28, Arizona State University, Tempe, Ariz.
7

8 Stone, C.L., 1986, *Deceptive Desolation: Prehistory of the Sonoran Desert in West Central*
9 *Arizona*, Cultural Resource Series No. 1, Bureau of Land Management, Phoenix, Ariz.
10

11 Stout, D., 2009, personal communication from Stout (U.S. Fish and Wildlife Service, Acting
12 Assistant Director for Fisheries and Habitat Conservation, Washington, D.C.) to L. Jorgensen
13 (Bureau of Land Management, Washington, D.C.) and L. Resseguie (Bureau of Land
14 Management Washington, D.C.), Sept. 14.
15

16 Turner, R.M., and D.E. Brown, 1994, “Sonoran Desertscrub,” in *Biotic Communities:*
17 *Southwestern United States and Northwestern Mexico*, D.E. Brown (editor), University of Utah
18 Press, Salt Lake City, Utah.
19

20 U.S. Army Garrison Yuma Proving Ground, 2010, *Environmental Assessment: Impact Areas*
21 *Expansion, United States Army Yuma Proving Ground, Arizona*, Environmental Sciences
22 Davison, Directorate of Public Works, Yuma, Ariz., March. Available at [http://www.yuma.](http://www.yuma.army.mil/docs/IAExpansion_EA_Draft_FONSI_25Mar10.pdf)
23 [army.mil/docs/IAExpansion_EA_Draft_FONSI_25Mar10.pdf](http://www.yuma.army.mil/docs/IAExpansion_EA_Draft_FONSI_25Mar10.pdf). Accessed July 26, 2010.
24

25 U.S. Bureau of the Census, 2009a, *County Business Patterns, 2006*, Washington, D.C. Available
26 at <http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html>.
27

28 U.S. Bureau of the Census, 2009b, *GCT-T1. Population Estimates*. Available at [http://factfinder.](http://factfinder.census.gov/)
29 [census.gov/](http://factfinder.census.gov/).
30

31 U.S. Bureau of the Census, 2009c, *QT-P32. Income Distribution in 1999 of Households and*
32 *Families: 2000. Census 2000 Summary File (SF 3) – Sample Data*. Available at
33 <http://factfinder.census.gov/>.
34

35 U.S. Bureau of the Census, 2009d, *S1901. Income in the Past 12 Months. 2006-2008 American*
36 *Community Survey 3-Year Estimates*. Available at <http://factfinder.census.gov/>.
37

38 U.S. Bureau of the Census, 2009e, *GCT-PH1. Population, Housing Units, Area, and*
39 *Density: 2000. Census 2000 Summary File (SF 1) – 100-Percent Data*. Available at
40 <http://factfinder.census.gov/>.
41

42 U.S. Bureau of the Census, 2009f, *T1. Population Estimates*. Available at
43 <http://factfinder.census.gov/>.
44

1 U.S. Bureau of the Census, 2009g, *GCT2510. Median Housing Value of Owner-Occupied*
2 *Housing Units (Dollars). 2006-2008 American Community Survey 3-Year Estimates*. Available
3 at <http://factfinder.census.gov/>.
4

5 U.S. Bureau of the Census, 2009h, *QT-H1. General Housing Characteristics, 2000. Census*
6 *2000 Summary File 1 (SF 1) 100-Percent Data*. Available at <http://factfinder.census.gov/>.
7

8 U.S. Bureau of the Census, 2009i, *GCT-T9-R. Housing Units, 2008. Population Estimates*.
9 Available at <http://factfinder.census.gov/>.
10

11 U.S. Bureau of the Census, 2009j, *S2504. Physical Housing Characteristics for Occupied*
12 *Housing Units 2006-2008 American Community Survey 3-Year Estimates*. Available at
13 <http://factfinder.census.gov/>.
14

15 U.S. Bureau of the Census, 2009k, *Census 2000 Summary File 1 (SF 1) 100-Percent Data*.
16 Available at <http://factfinder.census.gov/>.
17

18 U.S. Bureau of the Census, 2009l, *Census 2000 Summary File 3 (SF 3) - Sample Data*. Available
19 at <http://factfinder.census.gov/>
20

21 U.S. Bureau of Reclamation, 2003, *Parker Dam and Powerplant*, Lower Colorado Regional
22 Office. Available at <http://www.usbr.gov/lc/region/pao/parker.html>. Accessed July 27, 2010.
23

24 USDA (U.S. Department of Agriculture), 2004, *Understanding Soil Risks and Hazards—Using*
25 *Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property*, G.B. Muckel
26 (editor).
27

28 USDA, 2009a, *2007 Census of Agriculture: Arizona State and County Data, Vol. 1, Geographic*
29 *Area Series*, National Agricultural Statistics Service, Washington, DC. Available at
30 [http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_L](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Arizona/index.asp)
31 [evel/Arizona/index.asp](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Arizona/index.asp).
32

33 USDA, 2009b, *2007 Census of Agriculture: California State and County Data, Vol. 1,*
34 *Geographic Area Series*, National Agricultural Statistics Service, Washington, DC. Available at
35 [http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/California/index.asp)
36 [Level/California/index.asp](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/California/index.asp).
37

38 USDA, 2009c, *Western Irrigated Agriculture, Data Sets*. Available at [http://www.ers.usda.gov/](http://www.ers.usda.gov/data/westernirrigation)
39 [data/westernirrigation](http://www.ers.usda.gov/data/westernirrigation). Accessed Nov. 20.
40

41 USDA, 2010a, *Plants Database*, United States Department of Agriculture, Natural Resources
42 Conservation Service. Available at <http://plants.usda.gov>. Accessed June 23, 2010.
43

44 USDA, 2010b, *National Agricultural Statistics Service—Quick Stats, Arizona County Data*
45 *(Crops and Animals)*. Available at [http://www.nass.usda.gov/QuickStats/Create_County_](http://www.nass.usda.gov/QuickStats/Create_County_Indv.jsp)
46 [Indv.jsp](http://www.nass.usda.gov/QuickStats/Create_County_Indv.jsp). Accessed July 23, 2010.

1 U.S. Department of Commerce, 2009, *Local Area Personal Income*, Bureau of Economic
2 Analysis. Available at <http://www.bea.doc.gov/bea/regional/reis>.
3

4 U.S. Department of Justice, 2008, “Table 80: Full-time Law Enforcement Employees, by State
5 by Metropolitan and Nonmetropolitan Counties, 2007,” *2007 Crime in the United States*, Federal
6 Bureau of Investigation, Criminal Justice Information Services Division, Sept. Available at
7 http://www.fbi.gov/ucr/cius2007/data/table_80.html. Accessed June 17, 2010.
8

9 U.S. Department of Justice, 2009a, “Table 8: Offences Known to Law Enforcement, by State and
10 City,” *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice
11 Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.
12

13 U.S. Department of Justice, 2009b, “Table 10: Offences Known to Law Enforcement, by State
14 and by Metropolitan and Non-metropolitan Counties,” *2008 Crime in the United States*, Federal
15 Bureau of Investigation, Criminal Justice Information Services Division. Available at
16 http://www.fbi.gov/ucr/cius2008/data/table_10.html.
17

18 U.S. Department of Labor, 2009a, *Local Area Unemployment Statistics: States and Selected*
19 *Areas: Employment Status of the Civilian Noninstitutional Population, 1976 to 2007, Annual*
20 *Averages*, Bureau of Labor Statistics. Available at <http://www.bls.gov/lau/staadata.txt>.
21

22 U.S. Department of Labor, 2009b, *Local Area Unemployment Statistics: Unemployment Rates*
23 *for States*, Bureau of Labor Statistics. Available at <http://www.bls.gov/web/laumstrk.htm>.
24

25 U.S. Department of Labor, 2009c, *Local Area Unemployment Statistics: County Data*, Bureau of
26 Labor Statistics. Available at <http://www.bls.gov/lau>.
27

28 U.S. Department of the Interior, 2010, *Native American Consultation Database*, National
29 NAGPRA Online Databases, National Park Service. Available at [http://grants.cr.nps.gov/nacd/](http://grants.cr.nps.gov/nacd/index.cfm)
30 [index.cfm](http://grants.cr.nps.gov/nacd/index.cfm).
31

32 USFS (U.S. Forest Service), 2007, *Wild Horse and Burro Territories*, Rangelands Management,
33 Washington, D.C. Available at [http://www.fs.fed.us/rangelands/ecology/wildhorseburro//](http://www.fs.fed.us/rangelands/ecology/wildhorseburro//territories/index.shtml)
34 [territories/index.shtml](http://www.fs.fed.us/rangelands/ecology/wildhorseburro//territories/index.shtml). Accessed Oct. 20, 2009.
35

36 USFWS (U.S. Fish and Wildlife Service), 1994, *Desert Tortoise (Mojave Population) Recovery*
37 *Plan*, U.S. Fish and Wildlife Service, Portland, Ore.
38

39 USFWS, 2009a, *National Wetlands Inventory*. Available at <http://www.fws.gov/wetlands>.
40

41 USFWS, 2009b, *Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa*
42 *National Wildlife Refuge*, Final Environmental Assessment, U.S. Department of the Interior,
43 Kofa National Wildlife Refuge, Dec. Available at [http://www.fws.gov/southwest/refuges/](http://www.fws.gov/southwest/refuges/arizona/kofa/docs/KofaMtLionContFinalEA.pdf)
44 [arizona/kofa/docs/KofaMtLionContFinalEA.pdf](http://www.fws.gov/southwest/refuges/arizona/kofa/docs/KofaMtLionContFinalEA.pdf). Accessed July 27, 2010.
45

1 USFWS, 2010a, *Environmental Conservation Online System (ECOS)*, U.S. Fish and
2 Wildlife Service, Available at <http://www.fws.gov/ecos/ajax/ecos/indexPublic.do>. Accessed
3 May 28, 2010.
4

5 USFWS, 2010b, “Endangered and Threatened Wildlife and Plants; 12-Month Finding on a
6 Petition to List the Sonoran Desert Population of the Bald Eagle as a Threatened or Endangered
7 Distinct Population Segment,” *Federal Register* 75:8601-8621.
8

9 USGS (U.S. Geological Survey), 2000, *Desert Basins of the Southwest*, USGS Fact
10 Sheet 086-00. Available at <http://water.usgs.gov/ogw/pubs/fs00086/pdf/fs-086-00.pdf>.
11

12 USGS, 2004, *National Gap Analysis Program, Provisional Digital Land Cover Map for the*
13 *Southwestern United States*, Ver. 1.0, RS/GIS Laboratory, College of Natural Resources, Utah
14 State University. Available at <http://earth.gis.usu.edu/swgap/landcover.html>. Accessed
15 March 15, 2010.
16

17 USGS, 2005a, *National Gap Analysis Program, Southwest Regional GAP Analysis Project—*
18 *Land Cover Descriptions*, RS/GIS Laboratory, College of Natural Resources, Utah State
19 University. Available at http://earth.gis.usu.edu/swgap/legend_desc.html. Accessed
20 March 15, 2010.
21

22 USGS, 2005b, *Southwest Regional GAP Analysis Project*, U.S. Geological Survey National
23 Biological Information Infrastructure. Available at [http://fws-nmcfwru.nmsu.edu/
24 swregap/habitatreview/Review.asp](http://fws-nmcfwru.nmsu.edu/swregap/habitatreview/Review.asp).
25

26 USGS, 2007, *National Gap Analysis Program, Digital Animal-Habitat Models for the*
27 *Southwestern United States*, Version 1.0, Center for Applied Spatial Ecology, New Mexico
28 Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available at
29 <http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm>. Accessed March 15, 2010.
30

31 USGS, 2008, *National Seismic Hazard Maps – Peak Horizontal Acceleration (%g) with 10%*
32 *Probability of Exceedance in 50 Years (Interactive Map)*. Available at: [http://gldims.cr.usgs.
33 gov/nshmp2008/viewer.htm](http://gldims.cr.usgs.gov/nshmp2008/viewer.htm). Accessed Aug. 4, 2010.
34

35 USGS, 2010a, *Water Resources of the United States—Hydrologic Unit Maps*. Available at
36 <http://water.usgs.gov/GIS/huc.html>. Accessed April 12, 2010.
37

38 USGS, 2010b, *National Water Information System*. Available at [http://wdr.water.usgs.gov/
39 nwisgmap](http://wdr.water.usgs.gov/nwisgmap). Accessed June 15, 2010.
40

41 USGS, 2010c, *National Earthquake Information Center (NEIC—Circular Area Search (within*
42 *100-km of the center of the proposed Millers SEZ)*. Available at [http://earthquake.usgs.gov/
43 earthquakes/eqarchives/epic/epic_circ.php](http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php). Accessed July 22, 2010.
44
45

1 USGS, 2010d, *California Regional Gap Analysis Project (CAREGAP)*, National Biological
2 Informatics Infrastructure (NBII). Available at [http://gapanalysis.nbii.gov/portal/community/
3 GAP_Analysis_Program/Communities/Maps,_Data,_&_Reports/Find_Updated_GAP_
4 Regional_Data](http://gapanalysis.nbii.gov/portal/community/GAP_Analysis_Program/Communities/Maps,_Data,_&_Reports/Find_Updated_GAP_Regional_Data). Accessed March 4, 2010.
5
6 USGS, 2010e, *Glossary of Terms on Earthquake Maps – Magnitude*. Available at
7 <http://earthquake.usgs.gov/earthquakes/glossary.php#magnitude>. Accessed Aug. 8, 2010.
8
9 USGS and AGS (Arizona Geological Survey), 2010, *Quaternary Fault and Fold Database for
10 the United States*. Available at: <http://earthquake.usgs.gov/regional/qfaults/>. Accessed
11 Oct. 7, 2010.
12
13 WildEarth Guardians and Western Watersheds Project, 2008, “Petition to List the Sonoran
14 Desert Tortoise (*Gopherus agassizii*) Under the U.S. Endangered Species Act,” Petition to the
15 U.S. Fish and Wildlife Service, Oct. 9, 2008.
16
17 Wood, C.A., and J. Kienle (editors), 1992, *Volcanoes of North America*, Cambridge University
18 Press.
19
20 WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System
21 (EDMS)*. Available at <http://www.wrapedms.org/default.aspx>. Accessed June 4, 2009.
22
23 WRCC (Western Regional Climate Center), 2010, *Western U.S. Climate Historical Summaries*.
24 Available at <http://www.wrcc.dri.edu/Climsum.html>. Accessed July 10, 2010.
25
26 Wullenjohn, C., 2010, *Yuma Proving Ground Continues Army’s Area History*. Available at
27 http://www.yuma.army.mil/site_about.shtml.
28
29 XL Renewables, 2010, *Phyco 160 Project: \$10 Million Production and Processing Facility*,
30 Phoenix, Ariz. Available at <http://www.xlbiorefinery.com/biodetail.cfm?ContentKey=13839>.
31 Accessed July 27, 2010.
32
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1 **8.2 BULLARD WASH**

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3
4 **8.2.1 Background and Summary of Impacts**

5
6
7 **8.2.1.1 General Information**

8
9 The proposed Bullard Wash SEZ is located in Yavapai County in west-central Arizona
10 (Figure 8.2.1.1-1). The SEZ has a total area of 7,239 acres (29.3 km²). In 2008, the county
11 population was 214,930, while adjacent Maricopa County to the south had a population of
12 3,958,263. The nearest town is Aguila, Arizona, about 12 mi (19 km) south in Maricopa County,
13 with a population of approximately 1,000. The Phoenix metropolitan area is approximately 70 mi
14 (113 km) to the southeast of the SEZ.

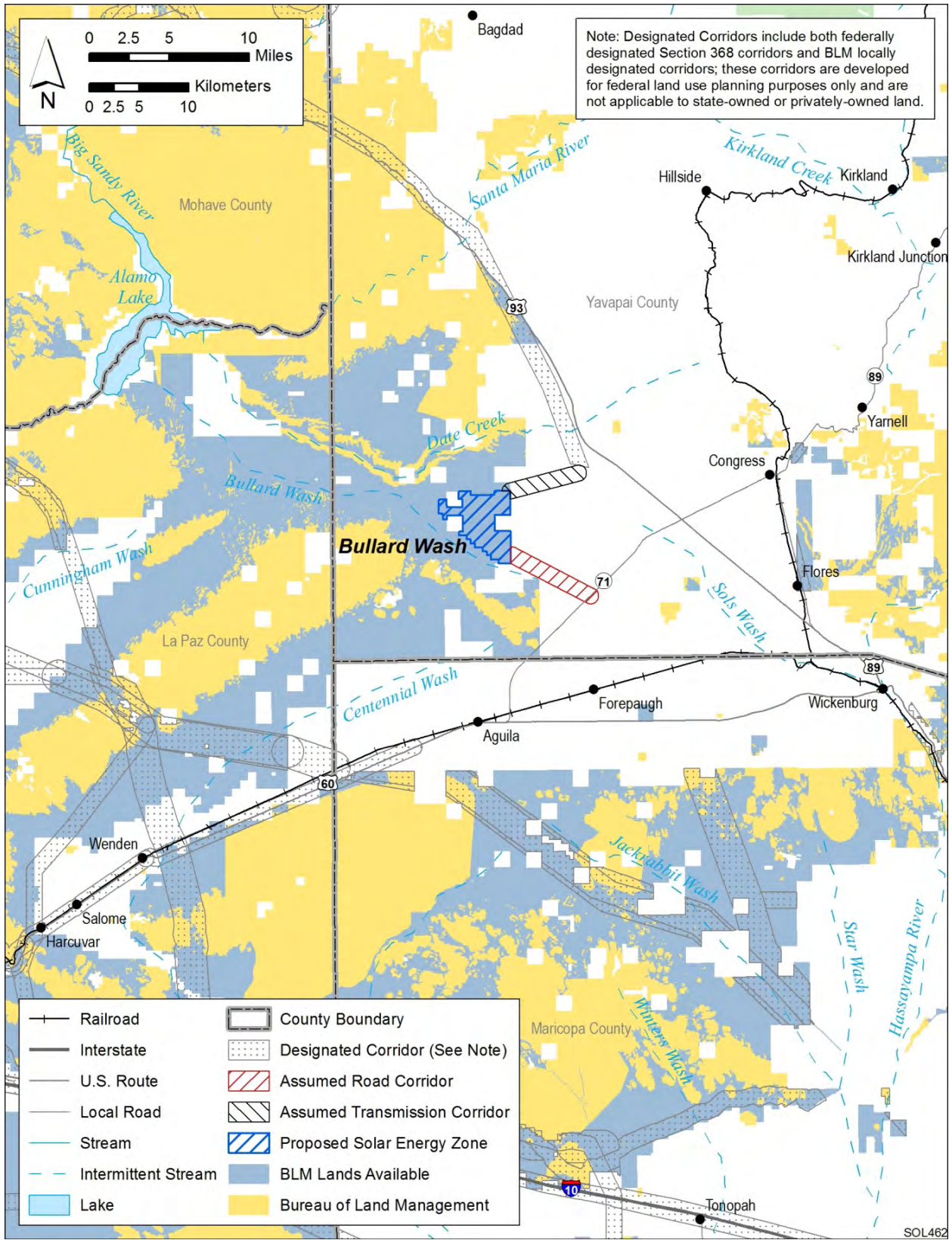
15
16 The nearest major road access to the SEZ is via State Route 71, which passes 5 mi (8 km)
17 southeast of the southeastern tip of the SEZ along the southern border of the Bullard Wash SEZ.
18 The nearest railroad stop is approximately 17 mi (19 km) away, in Congress. The nearest airport,
19 Wickenburg Municipal Airport, is 22 mi (35 km) to the southeast of the SEZ and does not have
20 regularly scheduled passenger service. Phoenix Sky Harbor International Airport is a major
21 airport in Phoenix (86 mi [138 km]) to the east.

22
23 A 500-kV transmission line passes 5 mi (8 km) northeast of the SEZ. It is assumed that a
24 new transmission line would be needed to provide access from the SEZ to the transmission grid
25 (see Section 8.2.1.1.2).

26
27 There are no ROW applications for solar projects within the SEZ; however, there are
28 17 pending ROW applications for solar projects that would be located within 50 mi (80 km) of
29 the SEZ. These applications are discussed in Section 8.2.22.2.1.

30
31 The proposed Bullard Wash SEZ is undeveloped and rural, with few permanent
32 residents in the area. The SEZ is located in the Date Creek basin, in a valley lying between the
33 Black Mountains to the north, the Date Creek Mountains to the northeast, and the Harcuvar
34 Mountains to the southwest. Land within the SEZ is undeveloped scrubland characteristic of a
35 semiarid basin.

36
37 The proposed Bullard Wash SEZ and other relevant information are shown in
38 Figure 8.2.1.1-1. The criteria used to identify the SEZ as an appropriate location for solar
39 energy development included proximity to existing transmission lines or designated corridors,
40 proximity to existing roads, a slope of generally less than 2%, and an area of more than
41 2,500 acres (10 km²). In addition, the area was identified as being relatively free of other types
42 of conflicts, such as USFWS-designated critical habitat for threatened and endangered species,
43 ACECs, SRMAs, and NLCS lands (see Section 2.2.2.2 for the complete list of exclusions).
44 Although these classes of restricted lands were excluded from the proposed Bullard Wash
45 SEZ, other restrictions might be appropriate. The analyses in the following sections address
46 the affected environment and potential impacts associated with utility-scale solar energy



1

2 **FIGURE 8.2.1.1-1 Proposed Bullard Wash SEZ**

1 development in the proposed SEZ for important environmental, cultural, and socioeconomic
2 resources.

3
4 As initially announced in the *Federal Register* on June 30, 2009, the proposed Bullard
5 Wash SEZ encompassed 8,201 acres (33 km²). Subsequent to the study area scoping period, the
6 boundaries of the proposed Bullard Wash SEZ were altered somewhat to facilitate the BLM's
7 administration of the SEZ area. Borders with irregularly shaped boundaries were adjusted to
8 match the section boundaries of the Public Lands Survey System (PLSS) (BLM and USFS
9 2010c). The revised SEZ is approximately 962 acres (4 km²) smaller than the original SEZ
10 as published in June 2009.

11 12 13 **8.2.1.2 Development Assumptions for the Impact Analysis**

14
15 Maximum solar development of the Bullard Wash SEZ is assumed to be 80% of the
16 SEZ area over a period of 20 years, a maximum of 5,791 acres (23 km²). These values are
17 shown in Table 8.2.1.2-1, along with other development assumptions. Full development of the
18 Bullard Wash SEZ would allow development of facilities with an estimated total of 643 MW of
19 electrical power capacity if power tower, dish engine, or PV technologies were used, assuming
20 9 acres/MW (0.04 km²/MW) of land required, and an estimated 1,158 MW of power if solar
21 trough technologies were used, assuming 5 acres/MW (0.02 km²/MW) of land required.

22
23 Availability of transmission from SEZs to load centers will be an important consideration
24 for future development in SEZs. The nearest existing transmission line is a 500-kV line 5 mi
25 (8 km) northeast of the SEZ. It is possible that a new transmission line could be constructed from
26 the SEZ to this existing line, but the 500-kV capacity of that line could be inadequate for 643 to
27 1,158 MW of new capacity (note that a 500-kV line can accommodate approximately the load of
28 one 700-MW facility). At full build-out capacity, new transmission and/or upgrades of existing
29 transmission lines (in addition to or instead of construction of a connection to the nearest existing
30 line) might be required to bring electricity from the proposed Bullard Wash SEZ to load centers;
31 however, at this time the location and size of such new transmission facilities are unknown.
32 Generic impacts of transmission and associated infrastructure construction and of line upgrades
33 for various resources are discussed in Chapter 5. Project-specific analyses would need to identify
34 the specific impacts of new transmission construction and line upgrades for any projects
35 proposed within the SEZ.

36
37 For purposes of as complete an analysis of impacts of development in the SEZ as
38 possible, it was assumed that, at a minimum, a transmission line segment would be constructed
39 from the proposed Bullard Wash SEZ to the nearest existing transmission line to connect the
40 SEZ to the transmission grid. This assumption was made without additional information on
41 whether the nearest existing transmission line would actually be available for connection of
42 future solar facilities and without assumptions about upgrades of the line. Establishing a
43 connection to the line closest to the Bullard Wash SEZ would involve the construction of about
44 5 mi (8 km) of new transmission line outside of the SEZ. The ROW for this transmission line
45 would occupy approximately 152 acres (0.61 km²) of land, assuming a 250-ft (76-m) wide
46 ROW, a typical width for such a ROW. If a connecting transmission line were constructed

TABLE 8.2.1.2-1 Proposed Bullard Wash SEZ—Assumed Development Acreages, Solar MW Output, Access Roads, and Transmission Line ROWs

Total Acreage and Assumed Developed Acreage (80% of Total)	Assumed Maximum SEZ Output for Various Solar Technologies	Distance to Nearest State, U.S., or Interstate Highway	Distance and Capacity of Nearest Existing Transmission Line	Assumed Area of Transmission Line ROW and Road ROW	Distance to Nearest Designated Corridor ^e
7,239 acres and 5,791 acres ^a	643 MW ^b and 1,158 MW ^c	State Route 71 5 mi ^d	5 mi and 500 kV	152 acres; 36 acres	4 mi

^a To convert acres to km², multiply by 0.004047.

^b Maximum power output if the SEZ were fully developed using power tower, dish engine, or PV technologies, assuming 9 acres/MW (0.04 km²/MW) of land required.

^c Maximum power output if the SEZ were fully developed using solar trough technologies, assuming 5 acres/MW (0.02 km²/MW) of land required.

^d To convert mi to km, multiply by 1.609.

^e BLM-designated corridors are developed for federal land use planning purposes only and are not applicable to state-owned or privately owned land.

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to a different off-site grid location in the future, site developers would need to determine the impacts from construction and operation of that line. In addition, developers would need to determine the impacts of line upgrades if they were needed.

State Route 71 lies about 5 mi (8 km) to the southeast of the proposed Bullard Wash SEZ. Assuming construction of a new access road to reach State Route 71 would be needed to support construction and operation of solar facilities, approximately 36 acres (0.15 km²) of land disturbance would occur (a 60-ft [18.3-m] wide ROW was assumed).

8.2.1.3 Summary of Major Impacts and SEZ-Specific Design Features

In this section, the impacts and SEZ-specific design features assessed in Sections 8.2.2 through 8.2.21 for the proposed Bullard Wash SEZ are summarized in tabular form. Table 8.2.1.3-1 is a comprehensive list of impacts discussed in these sections; the reader may reference the applicable sections for detailed support of the impact assessment. Section 8.2.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

Only those design features specific to the proposed Bullard Wash SEZ are included in Sections 8.2.2 through 8.2.21 and in the summary table. The detailed programmatic design features for each resource area to be required under BLM’s proposed Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would also be required for development in this and other SEZs.

TABLE 8.2.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Bullard Wash SEZ and SEZ-Specific Design Features^a

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ could disturb up to 5,791 acres (23 km ²). Development of the SEZ for utility-scale solar energy production would establish a large, isolated industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Since the SEZ is rural and undeveloped, utility-scale solar energy development would be a new and dominant land use in the area.	None.
	Construction of new transmission facilities to connect solar facilities in the SEZ to the regional grid would disturb 152 acres (0.6 km ²) of land.	None.
	Construction of a new 5-mi (8-km) long road to connect the south end of the SEZ to that highway would result in new surface disturbance of about 36 acres (0.1 km ²) of public land.	Priority consideration should be given to utilizing the existing Alamo Road to provide construction and operational access to the SEZ.
Specially Designated Areas and Lands with Wilderness Characteristics	Wilderness characteristics in the Tres Alamos WA between 3.5 and 7 mi (6 and 11 km) of the border of the SEZ and within the viewshed of the SEZ would be adversely affected.	Consideration should be given to restricting development of solar facilities within 5 mi (8 km) of the Tres Alamos WA to avoid the most serious impacts on the WA. Consideration should be given to restricting solar facilities within the SEZ to lower profile facilities.
Rangeland Resources: Livestock Grazing	There would be small adverse impacts on the Pipeline Ranch and Central Arizona Ranch Company allotments.	Development of additional range improvements within the allotments should be considered to reduce the expected loss of livestock forage.
Rangeland Resources: Wild Horses and Burros	None.	None.
Recreation	Areas developed for solar energy production would be closed to recreational use. Inventoried OHV routes would be closed.	None.

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Military and Civilian Aviation	The military has expressed concern that any development in the SEZ that exceeds 250 ft (76 m) in height would interfere with military operations in three MTRs.	None.
	There would be no effect on civilian aviation facilities.	None.
Geologic Setting and Soil Resources	Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase. Impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. These impacts may be impacting factors for other resources (e.g., air quality, water quality, and vegetation).	None.
Minerals (fluids, solids, and geothermal resources)	None.	None.
Water Resources	Ground-disturbance activities (affecting 41% of the total area in the peak construction year) could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills.	Water resource analysis indicates that wet-cooling options would not be feasible. Other technologies should incorporate water conservation measures.
	Construction activities may require up to 1,816 ac-ft (2.3 million m ³) of water during the peak construction year.	During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain;
	Construction activities would generate as high as 74 ac-ft (91,000 m ³) of sanitary wastewater.	
	Assuming full development of the SEZ, operations would use the following amounts of water:	

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Water Resources (Cont.)	<ul style="list-style-type: none"> For parabolic trough facilities (1,158-MW capacity), 827 to 1,754 ac-ft/yr (1.0 million to 2.2 million m³/yr) for dry-cooled systems; 5,807 to 17,390 ac-ft/yr (7.2 million to 21.5 million m³/yr) for wet-cooled systems. For power tower facilities (643-MW capacity), 458 to 972 ac-ft/yr (0.6 million to 1.2 million m³/yr) for dry-cooled systems; 3,225 to 9,659 ac-ft/yr (4.0 million to 12 million m³/yr) for wet-cooled systems. For dish engine facilities (643-MW capacity), 329 ac-ft/yr (406,000 m³/yr). For PV facilities (643-MW capacity), 33 ac-ft/yr (40,700 m³/yr). Assuming full development of the SEZ, operations would generate up to 16 ac-ft/yr (20,000 m³/yr) of sanitary wastewater. 	<p>Before a new well is drilled within the Bill Williams basin, a Notice of Intent to Drill must be filed with ADWR, and any groundwater rights policy of the ADWR must be followed</p> <p>Groundwater monitoring and production wells should be constructed in accordance with state standards.</p> <p>Stormwater management plans and BMPs should comply with standards developed by the Arizona Department of Environmental Quality.</p> <p>Water for potable uses would have to meet or be treated to meet drinking water quality standards.</p> <p>Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site and downstream in Bullard Wash.</p>
Vegetation ^b	<p>Up to 80% (5,791 acres [23.4 km²]) of the SEZ would be cleared of vegetation; re-establishment of shrub communities in disturbed areas would likely be very difficult because of the arid conditions.</p> <p>Noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation.</p> <p>The deposition of fugitive dust from large areas of disturbed soil onto habitats outside a solar project area could result in reduced productivity or changes in plant community composition.</p>	<p>An Integrated Vegetation Management Plan, addressing invasive species control, and an Ecological Resources Mitigation and Monitoring Plan, addressing habitat restoration, should be approved and implemented to increase the potential for successful restoration of creosotebush-white bursage desert scrub communities and other affected habitats and to minimize the potential for the spread of noxious weeds or invasive species, such as those occurring in Yavapai County or the Bradshaw-Harquahala Planning Area, that could be introduced</p>

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Vegetation ^b (Cont.)	Grading could affect wetland, dry wash, dry wash woodland, mesquite bosque, riparian, Joshua tree, and saguaro cactus communities within the SEZ, access road, and transmission line corridors. Alteration of surface drainage patterns or hydrology could adversely affect downstream communities.	<p>as a result of solar energy project activities (see Section 8.2.10.2.2). Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.</p> <p>All wetland, dry wash, woodland, mesquite bosque, riparian, Joshua tree, and saguaro cactus communities within the SEZ or corridors should be avoided to the extent practicable and any impacts minimized and mitigated. Any Joshua trees or cacti that cannot be avoided should be salvaged. A buffer area should be maintained around wetland, dry washes, dry wash woodland, mesquite bosque habitats, and riparian habitats to reduce the potential for impacts. Transmission line towers should be sited and constructed to minimize impacts on these habitats and to span them whenever practicable.</p> <p>Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, dry wash woodland, mesquite bosque, and riparian habitats, including downstream occurrences resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition. Appropriate buffers and engineering controls would be determined through agency consultation.</p> <p>Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities, or riparian communities associated with springs, such as Yerba Mansa Spring or Tres Alamos Spring, or along the Santa Maria River.</p>

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Wildlife: Amphibians and Reptiles ^b	Direct impacts on amphibians and reptiles from development on the SEZ would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region). With implementation of proposed design features, indirect impacts would be expected to be negligible.	Isolated wetlands should be avoided.
Wildlife: Birds ^b	<p>Direct impacts on bird species would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region).</p> <p>Other impacts on birds could result from collision with vehicles and infrastructure (e.g., buildings and fences), surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. These indirect impacts are expected to be negligible with the implementation of design features.</p>	<p>The requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed.</p> <p>Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and the Arizona Game and Fish Department. A permit may be required under the Bald and Golden Eagle Protection Act.</p> <p>Wetland habitats, which could provide occasional watering and feeding sites for some bird species, should be avoided.</p>
Wildlife: Mammals ^b	<p>Direct impacts on big game, small game, furbearers, and small mammals from habitat disturbance and long-term habitat reduction/fragmentation would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region).</p> <p>In addition to habitat loss, other direct impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and harassment. These indirect impacts are expected to be negligible with the implementation of design features.</p>	<p>The fencing around solar energy projects should not block the free movement of mammals, particularly big game species.</p> <p>Wetland habitats, which could provide occasional watering and feeding sites for some mammal species, should be avoided.</p>

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Aquatic Biota ^b	<p>There are no permanent water bodies, streams, or wetlands present within the area of direct effects of either the proposed Bullard Wash SEZ or the presumed new access road and transmission line corridors. In the area of indirect effects, there are no perennial surface water features, but two intermittent and ephemeral streams (Creek and Bullard Wash) are present, Date Creek may contain aquatic habitat and biota, and both streams also flow into perennial surface waters. There is the potential that groundwater withdrawals could reduce surface water levels in streams and wetlands outside of the proposed SEZ. Because construction activities occur at least 0.2 mi (0.3 km) from any surface water features, the potential for introducing contaminants would be small, especially assuming required design features are implemented.</p>	Any wetlands within the SEZ should be avoided.
Special Status Species ^b	<p>Potentially suitable habitat for 39 special status species occurs in the affected area of the Bullard Wash SEZ. For all of these special status species, less than 1% of the potentially suitable habitat in the region occurs in the area of direct effects.</p> <p>There are four groundwater dependent species that occur outside of the areas of direct and indirect effects. Potential impacts on these species could range from small to large depending on the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals.</p>	<p>Pre-disturbance surveys should be conducted within the area of direct effects to determine the presence and abundance of special status species. Disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible for some species, translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies.</p> <p>Consultation with the USFWS and AZGFD should be conducted to address the potential for impacts on the following species currently listed as threatened or endangered under the ESA: Arizona cliff rose, desert</p>

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Special Status Species ^b (Cont.)		<p>pupfish, Gila topminnow, Sonoran bald eagle, and southwestern willow flycatcher. Consultation would identify an appropriate survey protocol, avoidance and minimization measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements (if necessary).</p> <p>Coordination with the USFWS and AZGFD should be conducted to address the potential for impacts on the Sonoran population of the desert tortoise, a species under review for listing under the ESA. Coordination would identify an appropriate survey protocol, and mitigation requirements, which may include avoidance, minimization, translocation, or compensation.</p> <p>Avoiding or minimizing disturbance to desert wash or riparian habitat within the area of direct effects could reduce or eliminate impacts on 15 special status species.</p> <p>Avoidance or minimization of groundwater withdrawals to serve solar energy development on the SEZ could reduce or eliminate impacts on four special status species. In particular, impacts on aquatic and riparian habitat associated with the Tres Alamos and Yerba Mansa springs should be avoided.</p>

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Special Status Species ^b (Cont.)		Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and AZGFD.
Air Quality and Climate	<p><i>Construction:</i> Predicted 24-hour and annual PM₁₀ and PM_{2.5} concentration levels could exceed the AAQS at the SEZ boundaries and in the immediate surrounding areas during the construction of solar facilities. However, concentrations would decrease quickly with distance. Modeling indicates that emissions from construction activities are not anticipated to exceed Class I PSD PM₁₀ increments at the nearest federal Class I area. In addition, construction emissions from the engine exhaust of heavy equipment and vehicles could affect somewhat AQRVs at nearby federal Class I areas.</p> <p><i>Operations:</i> Positive impact due to avoided emission of air pollutants from combustion-related power generation: 1.6 to 2.9% of total SO₂, NO_x, Hg, and CO₂ emissions from electric power systems in the state of Arizona avoided (up to 1,563 tons/yr SO₂, 2,406 tons/yr NO_x, 0.022 tons/yr Hg, and 1,725,000 tons/yr CO₂).</p>	None.
Visual Resources	<p>Solar development could produce large visual impacts on the SEZ and surrounding lands within the SEZ viewshed due to major modification of the character of the existing landscape.</p> <p>The SEZ is in an area of low scenic quality, but with few cultural disturbances present. Residents, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads. The residents nearest to the SEZ could be subjected to strong visual contrasts from solar energy development within the SEZ.</p>	None.

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Visual Resources (Cont.)	<p>The SEZ is located 3.5 mi (5.6 km) from the Tres Alamos WA. Because of the open views of the SEZ and elevated viewpoints, strong visual contrasts could be observed by WA visitors.</p> <p>The SEZ is located 8.6 mi (13.8 km) from the Arrastra Mountain WA. Because of the open views of the SEZ and elevated viewpoints, weak to moderate visual contrasts could be observed by WA visitors.</p> <p>Joshua Forest Scenic Road passes within 5.5 mi (8.9 km) of the SEZ and is in the viewshed of the SEZ for about 14 mi (22.5 km). Because of the proximity of Joshua Forest Scenic Road to the SEZ, moderate to strong visual contrasts could be observed by travelers on Joshua Forest Scenic Road.</p>	
Acoustic Environment	<p><i>Construction.</i> For construction activities occurring near the southern SEZ boundary, estimated noise levels at the nearest residences located about 5.6 mi (9 km) from the SEZ boundary would be well below a typical daytime mean rural background level of 40 dBA. In addition, an estimated 40 dBA L_{dn} at these residences is well below the EPA guidance of 55 dBA L_{dn} for residential areas.</p> <p><i>Operations.</i> For a facility located near the southern SEZ boundary, the predicted noise level from a parabolic trough or power tower facility would be about 27 dBA at the nearest residences, which is much lower than typical daytime mean rural background level of 40 dBA. If TES were not used (i.e., if the operation were limited to daytime, 12 hours only), the EPA guideline level of 55 dBA (as L_{dn} for residential areas) would not be exceeded outside of the proposed SEZ boundary. In the case of 6-hour TES, the estimated noise level at the nearest residences would be 37 dBA, which is higher than typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 42 dBA L_{dn}, which is well below the EPA guideline of 55 dBA L_{dn} for residential areas.</p>	None.

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Acoustic Environment (Cont.)	If the SEZ was developed with dish engine facilities, the estimated noise level at the nearest residences about 5.6 mi (9.0 km) from the SEZ boundary would be about 36 dBA, which is below typical daytime mean rural background level of 40 dBA. If assuming 12-hour daytime operation, the estimated 41 dBA L _{dn} at these residences would be well below the EPA guideline of 55 dBA L _{dn} for residential areas.	
Paleontological Resources	The potential for impacts on significant paleontological resources in the proposed SEZ is unknown. A more detailed investigation of the alluvial deposits is needed prior to project approval. A paleontological survey will likely be needed	The need for and the nature of any SEZ-specific design features would depend on the results of future paleontological investigations.
Cultural Resources	No surveys have been conducted in the proposed SEZ and no sites have been recorded to date. Direct impacts on significant cultural resources could occur in the proposed Bullard Wash SEZ; however, further investigation is needed. A cultural resources survey of the entire area of potential effects of any project proposed would first need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would need to follow to determine whether any are eligible for listing in the NRHP. Impacts on cultural resources also are possible in areas related to the transmission line ROW, as new areas of potential cultural significance could be directly affected by construction or opened to increased access from use.	SEZ-specific design features would be determined during consultations with the Arizona SHPO and affected Tribes and would depend on the findings of cultural surveys.

TABLE 8.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Bullard Wash SEZ	SEZ-Specific Design Features
Native American Concerns	The proposed SEZ is adjacent to montane areas formerly inhabited by the Yavapai that may be culturally important. Development within the SEZ may result in visual or audible disturbance to sacred areas in the mountains. The SEZ itself does contain plant and animal species traditionally important to the Yavapai. Development in the proposed SEZ would eliminate some traditionally important plants and some habitat of traditionally important animals. The importance of these resources relative to the plants and animal habitat that will remain undisturbed outside the SEZ must be determined in consultation with the affected Native American Tribe(s).	The need for and nature of SEZ-specific design features would be determined during government-to-government consultation with the affected Tribes.
Socioeconomics	<p><i>Construction:</i> 480 to 5,477 total jobs; \$28.4 million to \$339 million income in ROI for construction of solar facilities in the SEZ.</p> <p><i>Operations:</i> 18 to 414 annual total jobs; \$0.6 million to \$16.2 million annual income in the ROI.</p> <p><i>Construction of new transmission line:</i> 27 total jobs; \$1.4 million income.</p> <p><i>Construction of access road:</i> 122 total jobs; \$4.7 million income.</p>	None.
Environmental Justice	There are no minority and low-income populations within the 50 mi (80 km) radius around the boundary of the SEZ. Therefore, according to CEQ guidelines, there would be no impacts on minority or low-income populations.	None.
Transportation	The primary transportation impacts are anticipated to be from commuting worker traffic. Single projects could involve up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). This additional volume of traffic on U.S. 93 would represent an increase in traffic of about 30% percent for a single project in the area of the Bullard Wash SEZ.	None.

1
2 **Footnotes on next page.**

TABLE 8.2.1.3-1 (Cont.)

Abbreviations: AAQS = ambient air quality standards; AGFD = Arizona Game and Fish Department; ANHP = Arizona National Heritage Program; AQRV= air quality-related value; BLM = Bureau of Land Management; BMP = best management practice; CEQ = Council on Environmental Quality; CO₂ = carbon dioxide; dBA = A-weighted decibel; DoD = U.S. Department of Defense; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; L_{dn} = day-night average sound level; MTR = military training route; NO_x = nitrogen oxides; NP = National Park; NRHP = *National Register of Historic Places*; OHV = off-highway vehicle; PEIS = programmatic environmental impact statement; PM_{2.5} = particulate matter with an aerodynamic diameter of 2.5 μm or less; PM₁₀ = particulate matter with an aerodynamic diameter of 10 μm or less; PSD = prevention of significant deterioration; PV = photovoltaic; ROI = region of influence; ROW = right-of-way; SEZ = solar energy zone; SHPO = State Historic Preservation Office; SO₂ = sulfur dioxide; SRMA = Special Recreation Management Area; TES = thermal energy storage; USFWS = U.S. Fish and Wildlife Service; WA = Wilderness Area.

- ^a The detailed programmatic design features for each resource area to be required under BLM’s proposed Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in the proposed Bullard Wash SEZ.
- ^b The scientific names of all plants, wildlife, aquatic biota, and special status species are provided in Sections 8.2.10 through 8.2.12.

1 **8.2.2 Lands and Realty**

2
3
4 **8.2.2.1 Affected Environment**

5
6 The proposed Bullard Wash SEZ is a relatively small SEZ that is located on the eastern
7 edge of a large block of undeveloped public land administered by the BLM. The SEZ is bordered
8 to the east by a large block of undeveloped state land. The overall character of the land in the
9 SEZ area is rural and undeveloped and is used primarily for grazing and some recreational use.
10 A gravel and dirt road, known as Alamo Road, provides supplemental access to the Alamo
11 Reservoir from U.S. 93 and passes less than 0.5 mi (0.8 km) north of the SEZ. The SEZ is
12 located about 25 mi (40 km) northwest of Wickenburg, Arizona. There are no existing ROWs
13 within the proposed SEZ.

14
15 As of February 2010, there were no ROW applications for solar energy facility
16 development on the SEZ; there are, however, numerous applications on public lands to
17 the south of the SEZ (see Figure 8.2.22-1).

18
19
20 **8.2.2.2 Impacts**

21
22
23 **8.2.2.2.1 Construction and Operations**

24
25 Full development of the proposed Bullard Wash SEZ could disturb up to 5,791 acres
26 (23 km²) (Table 8.2.1.2-1). Development of the SEZ for utility-scale solar energy production
27 would establish an isolated, industrial area that would exclude many existing and potential uses
28 of the land, perhaps in perpetuity. Since the SEZ is rural and undeveloped, utility-scale solar
29 energy development would be a new and dominant land use in the area. It also is possible that
30 state lands located adjacent to the SEZ, with the State's agreement, could be developed in the
31 same or complementary manner as the public lands.

32
33 Should the proposed SEZ be identified as an SEZ in the ROD for this PEIS, the BLM
34 would still have discretion to authorize ROWs in the area until solar energy development was
35 authorized, and then future ROWs would be subject to the rights granted for solar energy
36 development. It is not anticipated that approval of solar energy development within the SEZ
37 would have a significant impact on public lands available for future ROWs in the area.

38
39
40 **8.2.2.2.2 Transmission Facilities and Other Off-Site Infrastructure**

41
42 Delivery of energy produced in the SEZ would require establishing connection to the
43 regional grid. For analysis purposes, it is assumed that initial connection to the grid would be
44 made to an existing 500-kV transmission line that is located 5 mi (8 km) northeast of the SEZ.
45 Construction of a new 5-mi (8-km) line to connect to this line would result in the disturbance
46 of about 152 acres (0.6 km²). Because State Route 71 is the closest highway to the SEZ, it is

1 assumed that a new 5-mi (8-km) road would be constructed to connect the south end of the SEZ
2 to that highway. This would result in the surface disturbance of about 36 acres (0.1 km²) of
3 public land. Alternative or additional access to the SEZ could be provided from U.S. 93, which
4 passes near the eastern side of the SEZ. In this case, improvement of the existing Alamo Road
5 could be undertaken. Roads and transmission lines would be constructed within the SEZ as part
6 of the development of the area.

8.2.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

11 Implementing the programmatic design features described in Appendix A, Section A.2.2,
12 as required under BLM's proposed Solar Energy Program would provide adequate mitigation for
13 some identified impacts.

14 A proposed design feature specific to the proposed SEZ is:

- 17 • Priority consideration should be given to utilizing the existing Alamo Road to
18 provide construction and operational access to the SEZ.

8.2.3 Specially Designated Areas and Lands with Wilderness Characteristics

8.2.3.1 Affected Environment

There are 13 specially designated areas within 25 mi (40 km) of the proposed Bullard Wash SEZ that potentially could be affected by solar energy development within the SEZ. The listed ACECs all have scenic values as one of the components supporting the designation. All but one of these areas is more than 5 mi (8 km) from the SEZ. The areas include (see Figure 8.2.3.1-1) the following:

- Wilderness Areas
 - Arrastra Mountain
 - Harcuvar Mountains
 - Harquahala Mountains
 - Hummingbird Springs
 - Rawhide Mountains
 - Tres Alamos
- Areas of Critical Environmental Concern
 - Three Rivers Riparian
 - Poachie Desert Tortoise Habitat
 - Harquahala
 - Black Butte
 - Vulture Mountains
- Scenic Roads/Back Country Byways
 - U.S. 93, Joshua Forest Scenic Road
 - Harquahala Back Country Byway

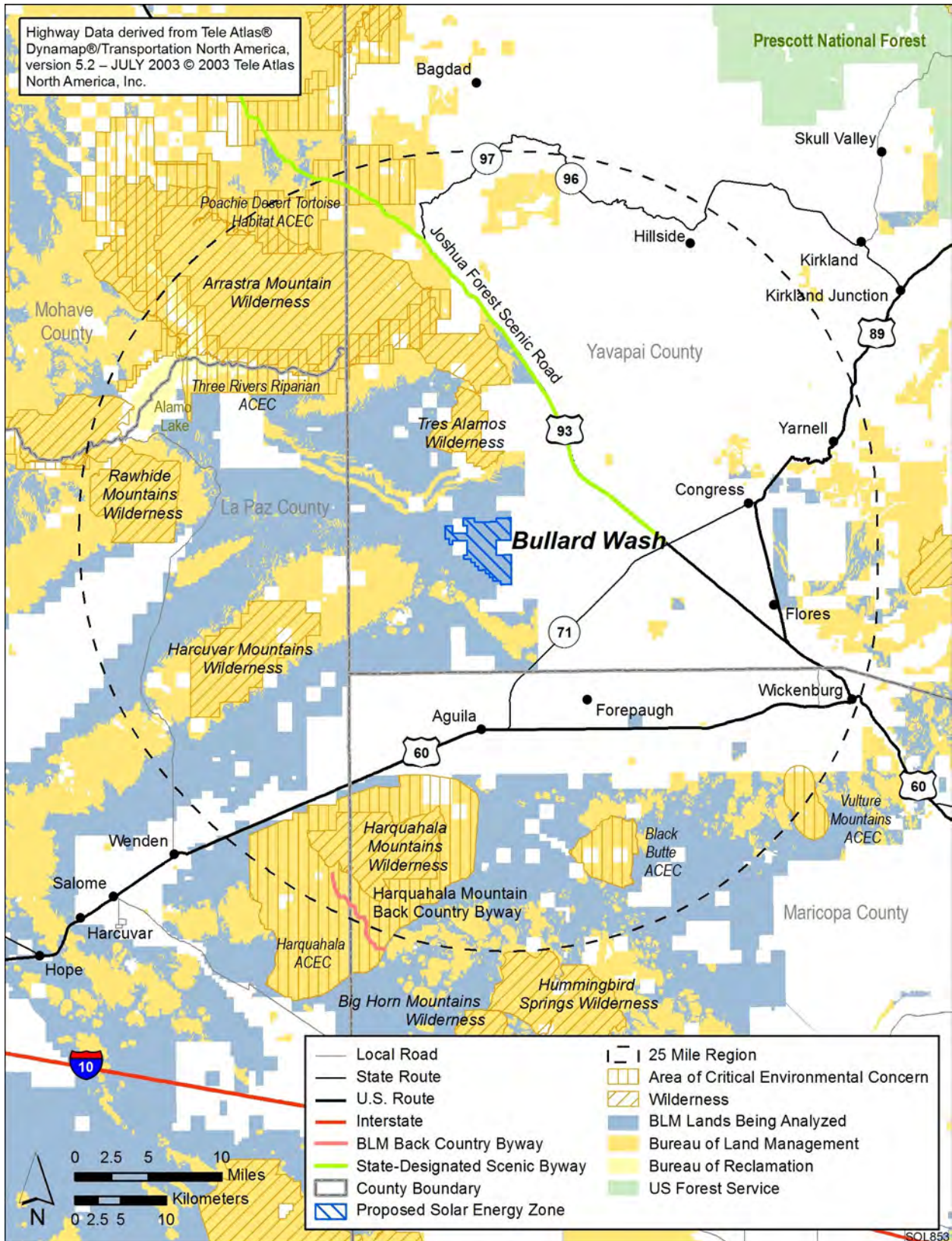
Viewshed analyses show that the Black Butte and Vulture Mountains ACECs and the Hummingbird Springs WA have less than 5% of their area in the viewshed of the SEZ, and that which is in the viewshed is more than 15 mi (24 km) from the SEZ. The Harquahala Back Country Byway is not in the viewshed of the SEZ. Because of these factors, these four areas are not considered further.

No undesignated areas with wilderness characteristics have been identified near the SEZ.

8.2.3.2 Impacts

8.2.3.2.1 Construction and Operations

The primary potential impact on the nine remaining areas near the SEZ would be from visual impacts of solar energy development that could affect scenic, recreational, or wilderness



1

2 **FIGURE 8.2.3.1-1 Specially Designated Areas in the Vicinity of the Proposed Bullard Wash SEZ**

1 characteristics of the areas. The visual impact on specially designated areas is difficult to
2 determine and would vary by solar technology employed, the specific area being affected, and
3 the perception of individuals viewing or using the areas. Development of the SEZ, especially full
4 development, would be an important visual component in the viewshed from portions of some
5 of these specially designated areas, as summarized in Table 8.2.3.2-1. The data provided in the
6 table, which shows the potential area of impact, assume the use of power tower solar energy
7 technology, which because of the potential height of these facilities, could be visible from the
8 largest amount of land of the technologies being considered in the PEIS. Viewshed analysis
9 for this SEZ has shown that the visibility of shorter solar energy facilities would be considerably
10 less in some areas than power tower technology (Section 8.2.14 provides detail on all viewshed
11 analyses discussed in this section). Potential impacts included below are general and assessment
12 of the visual impact of solar energy projects must be conducted on a site-specific and
13 technology-specific basis to accurately identify impacts.
14

15 In general, the closer a viewer is to solar development, the greater the effect is on an
16 individual's perception of impact. From a visual analysis perspective, the most sensitive viewing
17 distances generally are from 0 to 5 mi (0 to 8 km). The viewing height above or below a solar
18 energy development area, the size of the solar development area, and the purpose for which a
19 person is visiting an area are also important. Individuals seeking a wilderness or scenic
20 experience within these specially designated areas could be expected to be more adversely
21 affected than those simply traveling along the highway with another destination in mind. In the
22 case of the Bullard Wash SEZ the low-lying location of the SEZ in relation to portions of some
23 of the surrounding specially-designated areas would highlight the industrial-like development in
24 the SEZ.
25

26 The occurrence of glint and glare at solar facilities could potentially cause large though
27 temporary increases in brightness and visibility of the facilities. The visual contrast levels
28 projected for sensitive visual resource areas that were used to assess potential impacts on
29 specially designated areas do not account for potential glint and glare effects; however, these
30 effects would be incorporated into a future site- and project-specific assessment that would be
31 conducted for specific proposed utility-scale solar energy projects.
32

33 **Wilderness Areas**

34
35
36

37 **Tres Alamos.** This WA is the specially designated area closest to the SEZ. The area in
38 the WA that has visibility of the SEZ is 3.5 to 7 mi (6 to 11 km) from the SEZ. Wilderness
39 characteristics in the WA within 5 mi (8 km) of the border of the SEZ and within the viewshed
40 of the SEZ would be adversely affected by development within the SEZ because of the strong
41 visual contrast that would be created by solar facilities. Since visual impact can be considered as
42 a gradation of effect over distance as the distance from the SEZ increases, the level of impact on
43 wilderness characteristics would likely decrease. However, because such a large percentage of
44 the WA would be in the viewshed of the SEZ and within 7 mi (11 km) of the SEZ, the ability
45 to avoid the view of the SEZ is limited and may contribute to adverse effects on wilderness
46 characteristics over longer distances. It is anticipated that wilderness characteristics between

TABLE 8.2.3.2-1 Potentially Affected Specially Designated Areas within a 25-mi (40-km) Viewshed of the Proposed Bullard Wash SEZ^a

Feature Type	Feature Name (Total Acreage/Highway Length) ^b	Feature Area or Highway Length ^c		
		Visible within 5 mi	Visible within 5 and 15 mi	Visible within 15 and 25 mi
WAs	Arrastra Mountain (129,413 acres)	0 acres	3,653 acres (<1%)	16,727 acres (13%)
	Harcuvar Mountains (25,178 acres)	0 acres	796 acres (3%)	2,036 acres (8%)
	Harquahala Mountains (22,947 acres)	0 acres	0 acres	4,933 acres (22%)
	Hummingbird Springs (31,429 acres)	0 acres	0 acres	3 acres (<1%)
	Rawhide Mountains (37,968 acres)	0 acres	0 acres	4,433 acres (12%)
	Tres Alamos (8,278 acres)	1,694 acres (20%)	5,144 acres (62%)	5,144 acres (62%)
ACECs	Three Rivers Riparian (87,716 acres)	0 acres	503 acres (<1%)	3,981 acres (5%)
	Poachie Desert Tortoise Habitat (33,512 acres)	0 acres	0 acres	1,764 acres (5%)
	Harquahala (22,947 acres)	0 acres	3,180 acres (4%)	16,192 acres (21%)
	Black Butte (9,549 acres)	0 acres	0 acres	422 acres (4%)
	Vulture Mountains (6,497 acres)	0 acres	0 acres	128 acres (2%)
Scenic Roads	Joshua Forest Scenic Road (51 mi)	0 mi	14 mi (27%)	0 mi
	Harquahala Back Country Byway (7.6 mi)	0 mi	0 mi	0 mi

^a Assuming power tower technology with a height of 650 ft (198.1 m).

^b To convert acres to km², multiply by 0.004047. To convert mi to km, multiply by 1.609.

^c Percentage of total feature acreage or road length viewable.

1 5 and 7 mi (8 and 11 km) would also be adversely affected. In this case, the viewshed analysis
2 shows that shorter solar facilities would dramatically reduce the area in which wilderness
3 characteristics would be adversely affected (see Section 8.2.14 for a more thorough review of the
4 visual analysis).

5
6
7 **Arrastra Mountain WA.** The portion of the Arrastra Mountain WA nearest to the SEZ
8 is about 9 mi (14 km) distant. Between 9 and 15 mi (14 and 24 km) of the SEZ, less than 3% of
9 the WA is within the viewshed of the SEZ. At this distance, while solar development would be
10 visible, the contrast and field of view would be much reduced and would likely have only a
11 minimal impact on wilderness characteristics. Between 15 and 25 mi (24 and 40 km), another
12 10% of the WA would be within the viewshed of the SEZ. However, at this distance, the impact
13 on wilderness characteristics is anticipated to be minimal.

14
15
16 **Harcuvar Mountains WA.** The area of this WA within the viewshed of the SEZ is
17 between 9 and 20 mi (14 and 32 km) from the SEZ. Because the axis of the mountain range
18 within the WA is roughly perpendicular to the SEZ and because of some topographic screening,
19 generally only the higher elevations of the WA would have a view of development within the
20 SEZ. In the small percentage of the WA between 9 and 15 mi (14 and 24 km) of the SEZ, the
21 level of contrast and the field of view of the SEZ would be much reduced and would likely
22 have only a minimal effect on wilderness characteristics. Between 15 and 20 mi (24 and 32 km),
23 a larger percentage of the SEZ would be distantly visible but at this distance, because of the loss
24 of detail and contrast and the very narrow field of view of the SEZ, it is anticipated that there
25 would be no effect on wilderness characteristics. In addition, much of the southeastern side of
26 the WA would have a clear and closer view of agricultural and residential development in the
27 Aguila Valley that would also affect wilderness characteristics.

28
29
30 **Harquahala Mountains WA.** The portion of this WA nearest the SEZ is about 16 mi
31 (26 km) distant, and the area with visibility of the SEZ stretches to about 22 mi (35 km). While
32 solar facilities in the SEZ would be visible from slightly more than 20% of the area, because of
33 the distance from the SEZ, the level of contrast, and detail of solar facilities in the SEZ, the field
34 of view would be so reduced as to have a minimal impact on wilderness characteristics. This WA
35 also overlooks the development in the Aguila Valley, which would be viewed at the same time as
36 development in the SEZ and would further dilute the effect of the view of the SEZ.

37
38
39 **Rawhide Mountains WA.** The nearest portion of the WA to the SEZ is about 18 mi
40 (29 km) away, and areas of the WA within the viewshed of the SEZ stretch to 28 mi (45 km)
41 from the boundary of the SEZ. While almost 12% of the WA would have a distant view of the
42 SEZ, the level of contrast and detail of solar facilities in the SEZ, and field of view would be so
43 reduced, it is anticipated that there would be no impact on wilderness characteristics.

1 **Areas of Critical Environmental Concern**
2
3

4 **Harquahala ACEC.** The ACEC is a large area that encompasses much of the Harquahala
5 Mountains; it was designated for a variety of resource values, including scenery, primitive
6 landscapes, cultural resources, and unique biological assemblages. The ACEC completely
7 surrounds the Harquahala WA. The portions of the ACEC that are within the viewshed of the
8 SEZ include about 21% of the area and are restricted primarily to the northern and northeastern
9 slopes of the mountains. Areas of the ACEC with visibility of the SEZ range from 13 to 27 mi
10 (21 to 43 km) from the nearest boundary of the SEZ, and only the higher elevation areas closest
11 to the SEZ would have a good view of solar facilities in the SEZ, although the distance would
12 tend to mute the level of contrast and detail of the facilities and the field of view would not be
13 large. The farther distances would have decreasing views of the facilities in the SEZ to the point
14 that they would be largely inconsequential. The ACEC overlooks a wide area with a 360° view,
15 and the SEZ would make up only a small percentage of the overall panorama. Overall, it is
16 anticipated that there would be minimal impact on the scenic values of the ACEC. The other
17 resource values present in the ACEC would not be affected.
18
19

20 **Three Rivers Riparian ACEC and Poachie Desert Tortoise Habitat ACEC.** These
21 ACECs are designated to protect a range of resource values, including scenery, recreation,
22 riparian habitat, and desert tortoise and threatened and endangered species habitat. The portions
23 of these ACECs that are within the viewshed of the SEZ are almost completely located between
24 15 and 25 mi (24 and 40 km) from the SEZ, and the acreage of each ACEC that is within the
25 viewshed of the SEZ is about 5% of the total acreage. There are portions of the areas that could
26 have a view of solar facilities in the SEZ; however, because of the distance, reduced contrast
27 and lack of visible detail of the facilities in the SEZ, and the presence of screening vegetation in
28 some of the riparian areas, it is anticipated that there would be no impact on the visual resources
29 within these ACECs. Other resource values present in the ACEC would not be affected.
30
31

32 **Scenic Roads**
33

34 The Joshua Forest Scenic Road, U.S. 93, is located northeast of the SEZ, and visitors
35 traveling the road would be within 5.5 to 10 mi (9 to 16 km) of the SEZ along about a 14-mi
36 (23-km) segment of the road. The road is located at an elevation about 250 ft (76 m) higher than
37 the SEZ, and solar facilities within the SEZ would be visible from the road. Because of the
38 distance to the SEZ and the nature of highway travel, however, it is not anticipated that there
39 would be a significant adverse impact on the use of the scenic highway. While some highway
40 travelers might find the view of solar facilities in the SEZ objectionable, it is also possible that
41 some might find the solar energy development a point of interest.
42

43 Viewshed analysis of this area shows that there would be a large reduction in the road
44 mileage that would have visibility of facilities in the SEZ if solar technologies employing shorter
45 facilities were utilized.
46
47

1 **8.2.3.2.2 Transmission Facilities and Other Off-Site Infrastructure**
2

3 For analysis purposes, it is assumed that a new 5-mi (8-km) transmission line to transmit
4 solar power generated at the SEZ to the regional grid would be constructed from the northeastern
5 corner of the SEZ to an existing 500-kV transmission line located 5 mi (8 km) northeast of the
6 SEZ. Construction of this line would result in the disturbance of about 152 acres (0.6 km²), and
7 the new line would be visible from the Tres Alamos WA. The new transmission line would come
8 within 5 mi (8 km) of the WA and would be at the edge of the distance zone that is considered to
9 be most visually sensitive; thus it is possible that there could be some additional adverse impact
10 on wilderness characteristics in this WA caused by construction of this line.
11

12 It also is assumed that a new road connecting the SEZ to State Route 71, southeast of the
13 SEZ, would be constructed and that this construction would disturb 36 acres (0.1 km²). This road
14 would likely be visible from the Tres Alamos, Harcuvar Mountains, and Harquahala Mountains
15 WAs and from the Harquahala ACEC at distances ranging from 8 to 16 mi (13 to 26 km). The
16 distances are far enough away to minimize the visual impact of the road, and it is anticipated that
17 there would be no additional impacts on wilderness or scenic values associated with this road.
18

19 Roads and transmission lines would be constructed within the SEZ as part of the
20 development of the area and would contribute to the impact of solar facilities on surrounding
21 areas.
22

23
24 **8.2.3.3 SEZ-Specific Design Features and Design Feature Effectiveness**
25

26 Implementing the programmatic design features described in Appendix A, Section A.2.2,
27 as required under BLM's proposed Solar Energy Program would provide adequate mitigation
28 for some identified impacts. However, the Tres Alamos WA would incur adverse impacts on
29 wilderness characteristics.
30

31 Proposed design features specific to the proposed SEZ include the following:
32

- 33 • The Tres Alamos WA would incur adverse impacts on wilderness
34 characteristics. Consideration should be given to restricting development
35 of solar facilities within 5 mi (8 km) of the WA to avoid the most serious
36 impacts to the WA.
37
- 38 • Consideration also should be given to restricting solar facilities within the
39 SEZ to lower profile facilities. Both the Tres Alamos WA and the Joshua
40 Forest Scenic Road would experience relatively large reductions in potential
41 impacts on visual and wilderness resources if shorter solar energy facilities
42 were required.
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1 **8.2.4 Rangeland Resources**
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3 Rangeland resources include livestock grazing and wild horses and burros, both of
4 which are managed by the BLM. These resources and possible impacts on them from solar
5 development within the proposed Bullard Wash SEZ are discussed in Sections 8.2.4.1
6 and 8.2.4.2.
7
8

9 **8.2.4.1 Livestock Grazing**
10

11 **8.2.4.1.1 Affected Environment**
12

13
14 The proposed Bullard Wash SEZ includes portions of three perennial grazing allotments,
15 including the Pipeline Ranch, Forepaugh Cattle, and Central Arizona Ranch Company
16 allotments. In years with good spring rainfall, additional ephemeral grazing use may be
17 authorized to utilize above-average amounts of annual forage in addition to the base perennial
18 authorization. A number of water supplies occur in and around the SEZ, with at least two within
19 the SEZ boundaries. The Pipeline allotment is administered by the BLM Kingman Field Office,
20 and the other two allotments are administered by the Hassayampa Field Office. Table 8.2.4.1-1
21 summarizes key information regarding these allotments.
22
23

24 **8.2.4.1.2 Impacts**
25

26 **Construction and Operations**
27

28
29 Should utility-scale solar development occur in the SEZ, grazing would be excluded from
30 the areas developed as provided for in the BLM grazing regulations (43 CFR Part 4100). This
31
32

TABLE 8.2.4.1-1 Grazing Allotments within the Proposed Bullard Wash SEZ

Allotment	Total Acres ^a	% of Acres in SEZ ^b	Active BLM AUMs	No. of Permittees
Pipeline Ranch	28,401	12	1,838	1
Forepaugh Cattle	30,411	4	888	1
Central Arizona Ranch Company	39,357	7	2,329	1

^a Includes public, private, and state lands included in the allotment based on the Allotment Master Reports included in the BLM's Rangeland Administration System (BLM 2009a) and personal communication with BLM staff (Holden 2010).

^b This is the percentage of the total allotment acreage of the public lands located in the SEZ.

1 would include reimbursement of the permittee for their portion of the value for any range
2 improvements in the area removed from the grazing allotment. The impact of this change in
3 the grazing permits would depend on several factors, including (1) how much of an allotment
4 the permittee might lose to development, (2) how important the specific land lost is to the
5 permittee's overall operation, and (3) the amount of actual forage production that would be
6 lost by the permittee.
7

8 The Forepaugh Cattle allotment contains 9,199 acres (37 km²) of public land and
9 21,212 acres (86 km²) of state land. The total amount of authorized grazing use on the public
10 land portion of the allotment is 888 AUMs. Approximately 1,280 acres (5 km²) (14%) of the
11 public land in the allotment is located within the boundaries of the SEZ and would be lost to
12 grazing should full solar development occur. Assuming that the percentage reduction in
13 authorized AUMs would be the same as the percentage reduction in total area available for
14 grazing, the Forepaugh allotment could lose 124 AUMs from the public lands. Given the overall
15 size of the allotment, this is anticipated to be a small impact on the overall grazing operation.
16

17 The Central Arizona Ranch Company allotment has about 2,639 acres (10 km²) of public
18 lands included within the boundary of the proposed SEZ. If the same assumption is used that
19 the percentage reduction of AUMs would be the same as the percentage reduction in available
20 public land for grazing, the BLM authorized grazing permit would be reduced by about 7% or
21 163 AUMs. This is anticipated to result in a small impact on the grazing permittee.
22

23 There are about 3,352 acres (14 km²) or 12% of the Pipeline Ranch allotment within the
24 boundaries of the SEZ. With full solar development of the SEZ, it is anticipated that 220 AUMs
25 would be lost. This is anticipated to result in a small impact on the grazing permittee.
26

27 Quantification of the impact on the grazing permittees would require a specific analysis
28 involving, at a minimum, the three factors identified above. For the purposes of this PEIS, and
29 assuming a loss of AUMs as described previously, there would be a minimal impact on overall
30 livestock forage use within the two field offices from the designation and development of the
31 Bullard Wash SEZ. This conclusion is derived from comparing the projected loss of the
32 507 AUMs with the total BLM-authorized AUMs in the two offices for grazing year 2009 which
33 totaled 117,273 AUMs. This represents a loss of about 0.4%. The actual impact on the three
34 permittees could also be affected by any mitigation of the loss (e.g., through installation of new
35 range improvements) that could be accomplished on the remaining public lands in the allotments.
36
37

38 **Transmission Facilities and Other Off-Site Infrastructure**

39

40 For analysis purposes, it is assumed that the initial connection to the regional electric grid
41 would be accomplished by constructing a new transmission line from the SEZ to the existing
42 500-kV transmission line that is located 5 mi (8 km) northeast of the SEZ. Construction of
43 this line, assuming landowner approval, would largely be on state land and would result in
44 the disturbance of about 152 acres (0.6 km²) of land currently used for grazing. This level of
45 disturbance would not cause a significant additional loss of livestock grazing.
46

1 Also for purposes of analysis, it is assumed that a new road connecting the SEZ to State
2 Route 71, southeast of the SEZ, would be constructed on state lands located in the Forepaugh
3 allotment, and that this construction would disturb an additional 36 acres (0.1 km²). It is not
4 anticipated that this would create a significant additional loss of livestock grazing within the
5 Forepaugh allotment.
6
7

8 **8.2.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness**

9

10 Implementing the programmatic design features described in Appendix A, Section A.2.2,
11 as required under BLM's proposed Solar Energy Program, would provide adequate mitigation
12 for some identified impacts.
13

14 A proposed design feature specific to the proposed SEZ includes the following:
15

16 Development of additional range improvements within the allotments should be
17 considered to reduce the expected loss of livestock forage.
18
19

20 **8.2.4.2 Wild Horses and Burros**

21

22 **8.2.4.2.1 Affected Environment**

23

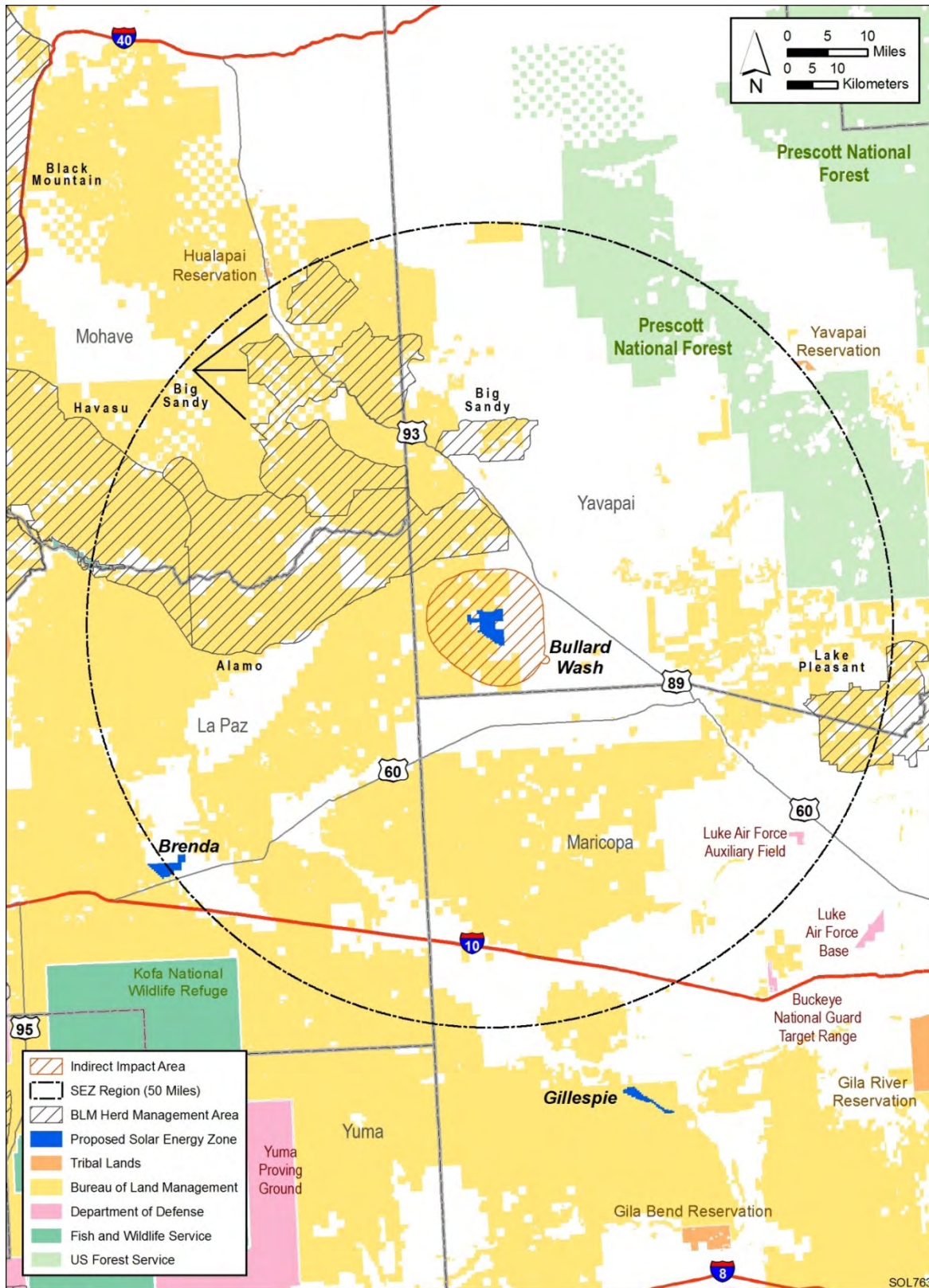
24 Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that
25 occur within the six-state study area. Seven wild horse and burro HMAs occur within
26 Arizona (BLM 2010c); portions of four of them (Alamo, Big Sandy, Havasu, and Lake Pleasant
27 HMAs) occur within the 50-mi (80-km) SEZ region for the proposed Bullard Wash SEZ
28 (Figure 8.2.4.2-1). None of the HMAs occur within the SEZ or indirect impact area of the SEZ.
29
30

31 In addition to the HMAs managed by the BLM, the USFS has wild horse and burro
32 territories in Arizona, California, Nevada, New Mexico, and Utah, and is the lead management
33 agency that administers 37 of the territories (Giffen 2009; USFS 2007). None of the territories
34 occurs within the SEZ region.
35
36

37 **8.2.4.2.2 Impacts**

38

39 Because the proposed Bullard Wash SEZ is about 7 mi (11 km) or more from any wild
40 horse and burro HMA managed by the BLM and more than 50 mi (80 km) from any wild horse
41 and burro territory administered by the USFS, solar energy development within the SEZ would
42 not directly affect wild horses and burros that are managed by these agencies.
43



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FIGURE 8.2.4.2-1 Wild Horse and Burro Herd Management Areas and Territories within the Analysis Area for the Proposed Bullard Wash SEZ (Source: BLM 2010c)

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8.2.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features for solar facilities within the proposed Bullard Wash SEZ would be necessary to protect or minimize impacts on wild horses and burros.

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1 **8.2.5 Recreation**

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4 **8.2.5.1 Affected Environment**

5
6 The proposed Bullard Wash SEZ is a well-vegetated area and is located just south of
7 the old Alamo Road, which provides good access to the area. While the area is generally flat,
8 numerous drainages cross the area and provide some topographic relief and there are Joshua
9 Trees present throughout the area. No visitor use data exist for the area, but a low level of
10 backcountry driving, OHV use, hunting, photography, and rockhounding are the most likely
11 recreational uses of the area. The area is included within the Bradshaw–Harquahala Resource
12 Management Plan area, and the whole planning area has been classified for eventual designation
13 of OHV uses as “limited to designated routes.” Pending completion of the formal route planning
14 process, road use is limited to travel on inventoried routes. The route inventory for the area of the
15 SEZ shows seven inventoried routes within the area of the SEZ (Baker and Bickauskas 2010).

16
17
18 **8.2.5.2 Impacts**

19
20
21 **8.2.5.2.1 Construction and Operations**

22
23 Recreational users would lose the use of any portions of the SEZ developed for solar
24 energy production, but this loss is anticipated to be minimal. Any inventoried routes that pass
25 through areas developed for solar power production could be closed or rerouted, although the
26 existing Alamo Road would continue to provide general east—west access.

27
28 The Tres Alamos WA is within 3.5 mi (6 km) of the SEZ, and solar development
29 within the SEZ would be very visible from areas within the WA. Whether the presence of
30 solar development in the SEZ would affect recreational use of the WA is unknown, but a large
31 percentage of the area is located within the most sensitive visual zone surrounding the proposed
32 SEZ. It is anticipated that some current and potential users of portions of the WA may choose to
33 relocate their activities in the WA farther away from solar energy facilities.

34
35 Travelers along the Joshua Forest Scenic Road would have a substantial view of solar
36 development within the SEZ over about 14 mi (23 km), but because the SEZ is located more
37 than 5 mi (8 km) from the highway, it is not likely that there would be any significant impact
38 on the use of the scenic road.

39
40 Solar development within the SEZ would affect public access along OHV routes
41 designated open and available for public use. If such routes were identified during project-
42 specific analyses, they would be redesignated as closed (see Section 5.5.1 for more details on
43 how routes coinciding with proposed solar facilities would be treated).

1 **8.2.5.2.2 Transmission Facilities and Other Off-Site Infrastructure**
2

3 The new 5-mi (8-km) transmission line connecting solar energy produced in the SEZ to
4 the regional grid would be visible from the Tres Alamos WA and the Joshua Forest Scenic Road.
5 The transmission line would converge with two existing transmission lines that are currently
6 visible from the scenic road, and for that reason, it is not anticipated that there would be any
7 additional impact on travelers on the road from the construction of the new line. Since the new
8 transmission line comes within 5 mi (8 km) of the WA, there is potential for the line to
9 contribute to the adverse impact on wilderness characteristics and a potential subsequent
10 reduction in recreational use within the WA. It is not anticipated that any additional impact
11 caused by the construction of the transmission line would be significant when compared with
12 the adverse impact on the WA already included in Section 8.2.3.2.1.
13

14 The new road that has been assumed to be necessary to connect the SEZ to State
15 Route 71, southeast of the SEZ, would not be close enough to any specially designated areas
16 to have an adverse effect on recreational use of those areas.
17

18
19 **8.2.5.3 SEZ-Specific Design Features and Design Feature Effectiveness**
20

21 Implementing the programmatic design features described in Appendix A, Section A.2.2,
22 as required under BLM’s proposed Solar Energy Program, would provide mitigation for
23 some impacts on recreation. However, some recreational use within the SEZ would be lost.
24 No SEZ-specific design features for solar facilities within the proposed Bullard Wash SEZ
25 are recommended.
26
27

1 **8.2.6 Military and Civilian Aviation**

2
3
4 **8.2.6.1 Affected Environment**

5
6 The SEZ is located within an extensive web of MTRs, and the entire SEZ is covered by a
7 combination of two MTRs with 300-ft (91-m) AGL operating limits. One of these routes is used
8 as a VFR corridor and one is an IFR corridor. The SEZ is located 57 mi (92 km) northwest of
9 Luke Air Force Base.

10
11 The closest public airport to the SEZ is the Wickenburg Municipal Airport located 25 mi
12 (40 km) to the southeast. This airport does not have regularly scheduled passenger or freight
13 service.

14
15
16 **8.2.6.2 Impacts**

17
18 The military has indicated that construction of solar or transmission facilities in excess
19 of 250 ft (76 m) tall would adversely affect the use of both of the MTRs.

20
21 The Wickenburg Municipal Airport is located far enough away from the proposed SEZ
22 that there would be no effect on airport operations.

23
24
25 **8.2.6.3 SEZ-Specific Design Features and Design Feature Effectiveness**

26
27 No SEZ-specific design features for solar development within the proposed Bullard Wash
28 SEZ would be necessary to protect impacts on military and civilian aviation. The programmatic
29 design features described in Appendix A, Section A.2.2, would require early coordination with
30 the DoD to identify and mitigate, if possible, the potential impacts on the use of MTRs.

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1 **8.2.7 Geologic Setting and Soil Resources**

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4 **8.2.7.1 Affected Environment**

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7 **8.2.7.1.1 Geologic Setting**

8
9
10 **Regional Setting**

11
12 The proposed Bullard Wash SEZ is located in Date Creek basin, an alluvial basin within
13 the Basin and Range physiographic province in west-central Arizona. The basin is near the
14 transition zone that marks the boundary between the eastern margin of the Basin and Range
15 province and the Colorado Plateau to the northeast. It has a northwest–southeast trend and is
16 bounded to the southwest by the Harcuvar, Buckskin, and Rawhide Mountains and to the
17 northeast by the Poachie Range, Black, and Date Creek Mountains. Low bedrock ridges and hills
18 separate the Date Creek basin from Aguila Valley to the south and Congress Basin to the east
19 (Figure 8.2.7.1-1). The basin straddles two structurally distinct areas: the western part of the
20 basin, which is cut by northwest-trending extensional faults (of Tertiary age) and large vertical
21 displacements of Tertiary rock; and the eastern part of the basin, where rocks are flat-lying and
22 unfaulted (Otton and Brooks 1978).

23
24 Boreholes drilled in the eastern part of Date Creek basin in the 1970s showed that the
25 basin-fill sediments were about 5,620 ft (1,720 m) deep; beyond this depth, basement rocks of
26 gneiss were encountered. Unconsolidated alluvial, eolian, and lacustrine sediments of Quaternary
27 age overlie the Chapin Wash Formation (Tertiary), occurring at a depth of about 1,130 ft
28 (350 m). The Chapin Wash Formation is at least 2,700 ft (830 m) thick and is composed of sandy
29 conglomerates, sandstone, fluvial-lacustrine rocks (facies), and some volcanics (tuffs, andesite,
30 and basalt). The lacustrine facies in the Chapin Wash Formation disappear to the west where thin
31 fluvial facies predominate (Otton and Wynn 1978; Bisdorf 1982).

32
33 Exposed sediments in the center of Date Creek basin are predominantly young
34 (<10,000 yr) alluvial deposits of gravel and sand (stream channels) and silt and clay (floodplains
35 and playas) and eolian sands (Qy); sedimentary rocks of conglomerate and sandstone of Tertiary
36 age (Tsy) form prominent bluffs along its margins, especially northwest of the Bullard Wash
37 SEZ (Figure 8.2.7.1-2). In the surrounding mountains, exposures are predominantly composed
38 of Tertiary volcanics and Tertiary-Cretaceous intrusives. The oldest rocks in the region are the
39 Precambrian to Mesozoic metamorphic and intrusive rocks (granites) that occur in the Buckskin
40 and Harcuvar Mountains to the west and southwest and the Date Creek and Weaver Mountains
41 to the northwest (Otton and Wynn 1978).

42
43
44 **Topography**

45
46 The Date Creek basin is an elongated basin that predominantly slopes to the northwest.
47 Elevations in the eastern part of the basin range from about 3,200 ft (980 m) at the base of the

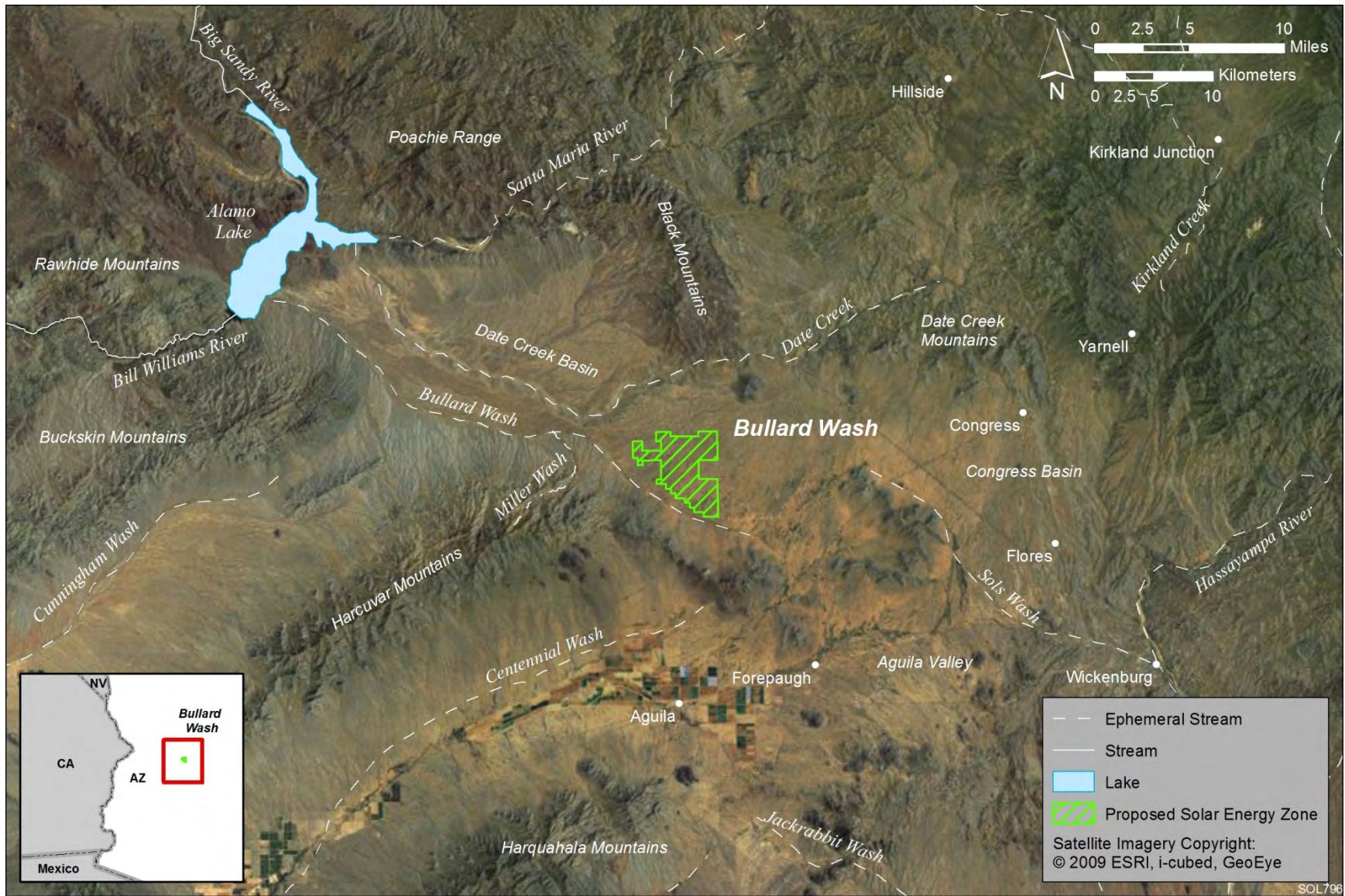
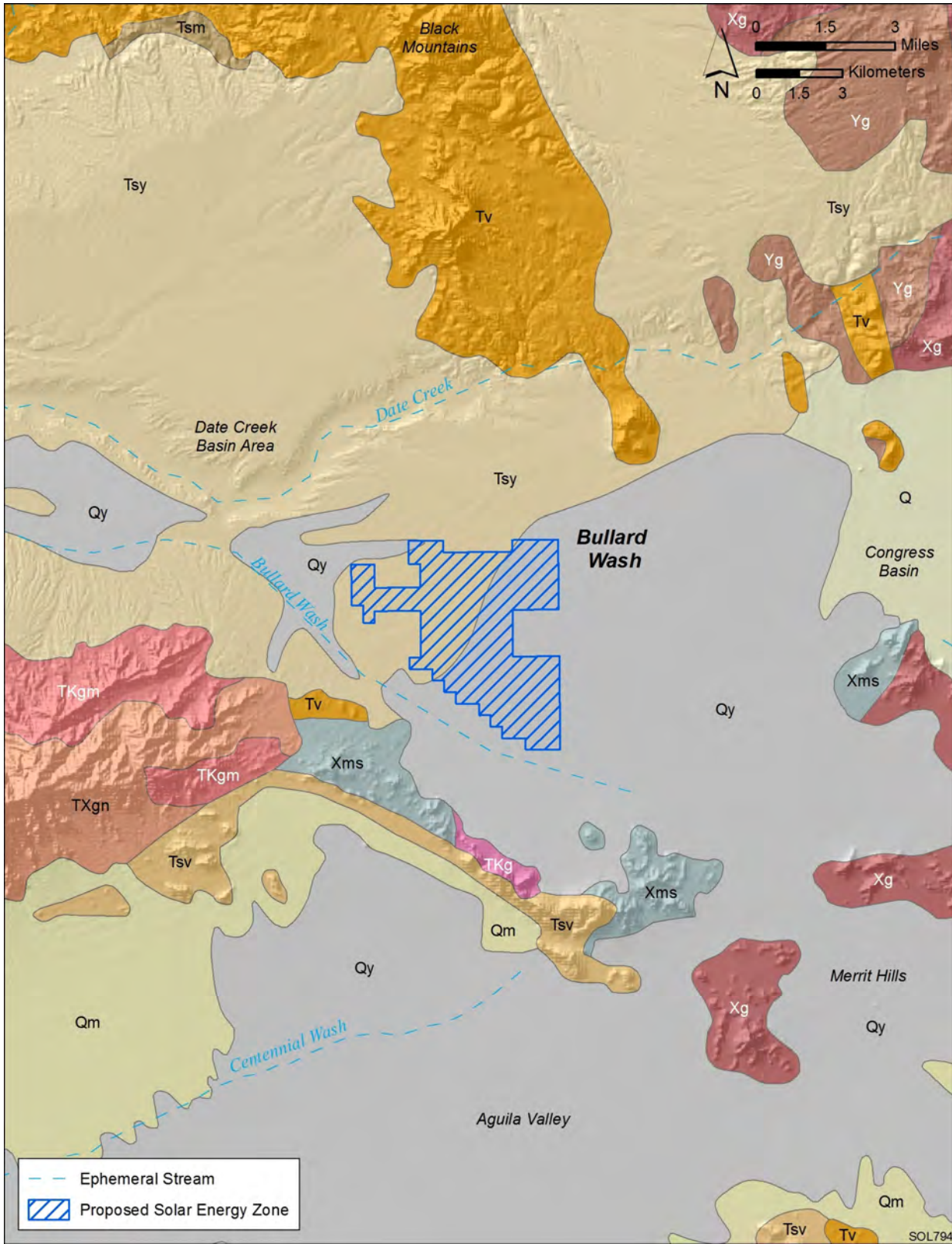


FIGURE 8.2.7.1-1 Physiographic Features of the Date Creek Basin Region



1

2 **FIGURE 8.2.7.1-2 Geologic Map of the Date Creek Basin Region (adapted from**
 3 **Ludington et al. [2007] and Richard et al. [2000])**

Cenozoic (Quaternary, Tertiary)

- Qy Young alluvium in stream channels and on flood plains and playas (0 to 10,000 yr)
- Q Surficial deposits, including wind-blown sand (0 to 2 m.y.)
- Qm Surficial deposits (10,000 to 750,000 yr)
- Tsy Consolidated conglomerate and sandstone
- Tsv Volcanic and sedimentary rocks, undivided
- Tsm Sedimentary rocks
- Tv Volcanic rocks
- TXgn Gneissic rocks (Early Proterozoic to Tertiary)
- TKgm Muscovite-bearing granitic rocks (associated with abundant pegmatite dikes)
- TKg Granitic rocks

Precambrian

- Yg Granitic rocks (1,400 to 1,450 m.y.)
- Xg Granitic rocks (1,600 to 1,800 m.y.)
- Xms Metasedimentary rocks

1

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2 **FIGURE 8.2.7.1-2 (Cont.)**

1 Date Creek Mountains to about 2,400 ft (730 m) along Bullard Wash (Figure 8.2.7.1-1). In the
2 western part of the basin, elevations range from about 2,140 ft (650 m), where Miller Wash
3 joins Bullard Wash near the center of the basin to about 1,200 ft (370 m), where Bullard Wash
4 discharges to Alamo Lake. The basin is also drained by Date Creek, which flows northwest to
5 the Santa Maria River. The Santa Maria River joins with the Big Sandy River just upstream of
6 Alamo Lake.
7

8 The proposed Bullard Wash SEZ is located in the eastern part of Date Creek basin,
9 between the Harcuvar Mountains to the southwest and the Date Creek Mountains to the
10 northeast. Date Creek, located north of the SEZ, flows northwest to the Santa Maria River.
11 Bullard Wash, southwest of the SEZ, also flows to the northwest and discharges to Alamo Lake
12 (Figure 8.2.7.1-1). The site terrain slopes gently to the southwest, with elevations ranging from
13 about 2,580 ft (790 m) at the northeastern corner to 2,360 ft (720 m) along the southwest-facing
14 border. Several unnamed drainages enter the SEZ from the northeast and drain to the southwest
15 toward Bullard Wash (Figure 8.2.7.1-3).
16
17

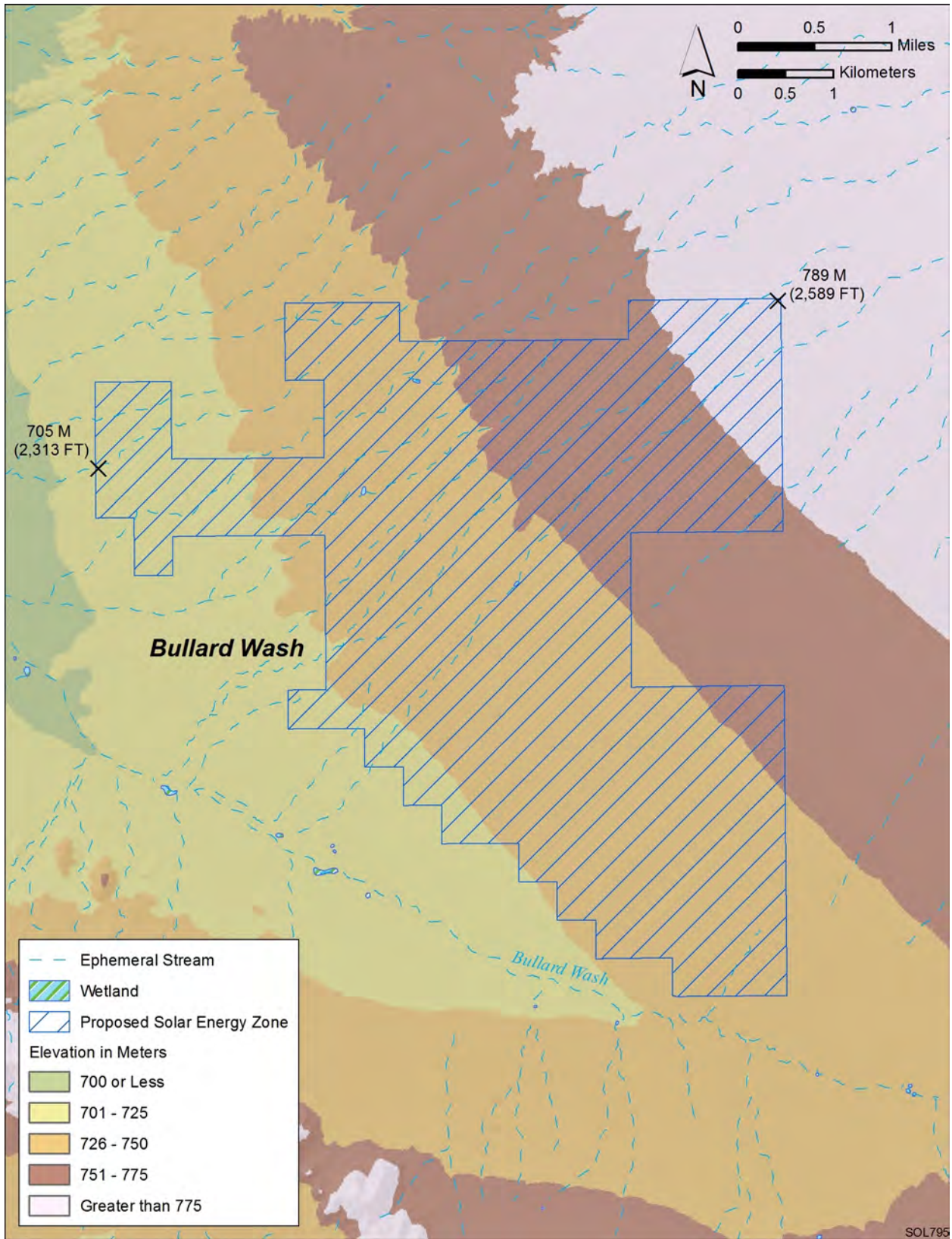
18 **Geologic Hazards**

19

20 The types of geologic hazards that could potentially affect solar project sites and their
21 mitigation are discussed in Section 5.7.3 and 5.7.4. The following sections provide a preliminary
22 assessment of these hazards at the proposed Bullard Wash SEZ. Solar project developers may
23 need to conduct a geotechnical investigation to assess geologic hazards locally to better identify
24 facility design criteria and site-specific design features to minimize their risk.
25
26

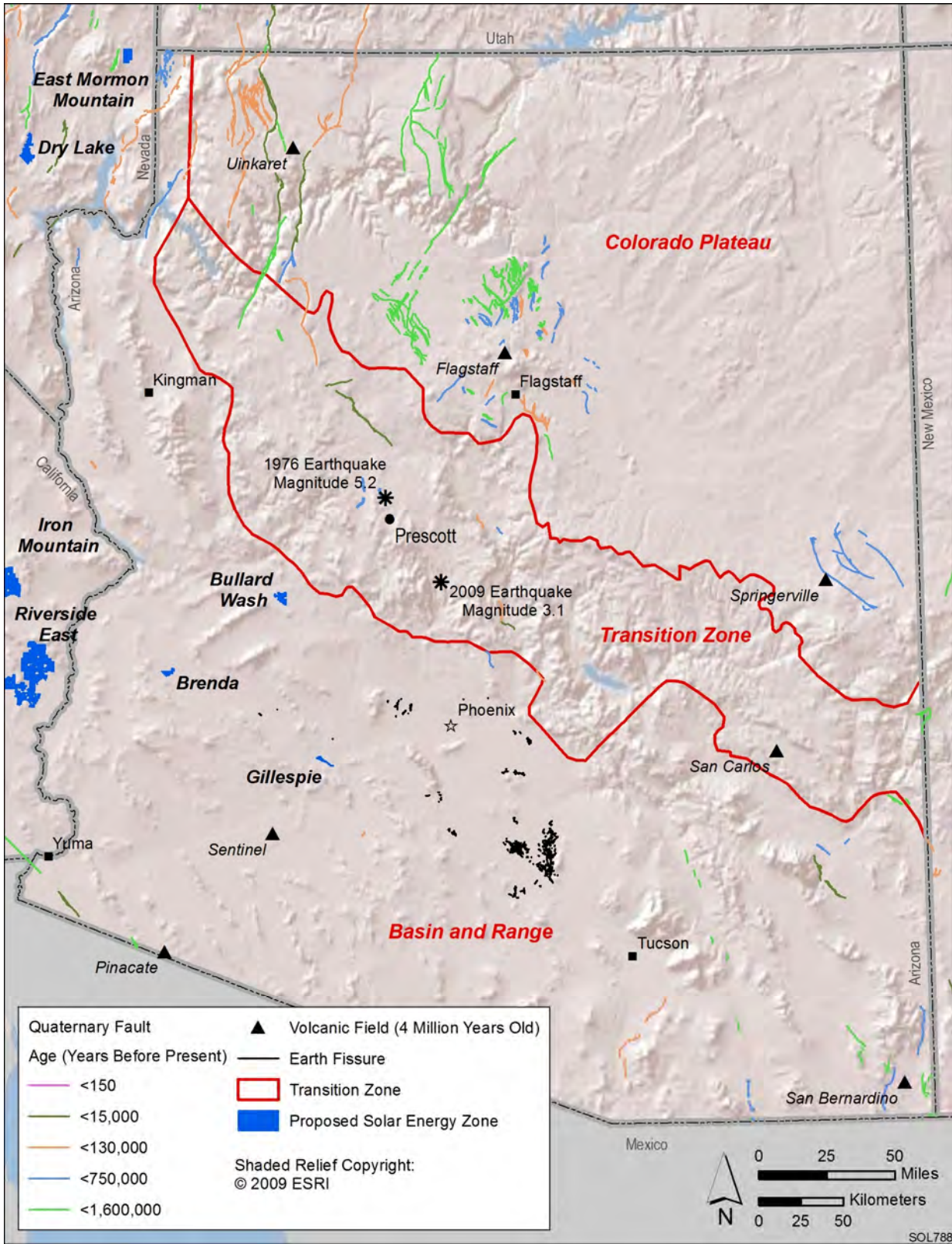
27 **Seismicity.** Most of the seismic activity in Arizona occurs along the northwest-trending
28 boundary (transition zone) between the Basin and Range and Colorado Plateau physiographic
29 provinces north of the three proposed Arizona SEZs (Figure 8.2.7.1-4). Of the Quaternary faults
30 in this zone, the Big Chino Fault, an extensional (normal) fault, is the closest to the proposed
31 Bullard Wash SEZ. It is located along the northeastern edge of Big Chino Valley, about 70 mi
32 (110 km) to the north–northeast of the SEZ. No Quaternary faults have been identified within
33 Date Creek basin (USGS and AZGS 2010); however, older faults of Tertiary age (between 18
34 and 20 million years ago) with displacements of 980 ft (300 m) have been observed in the
35 western part of the basin (Otton and Brooks 1978). Resistivity data also show faults with vertical
36 offsets in basement rocks, with some displacement of deeper basin fill (Bisdorf 1982).
37

38 The Big Chino fault has a northwest trend and extends the length of Big Chino Valley
39 (Figure 8.2.7.1-4). Well-defined scarps along most of the fault trace indicate that middle to late
40 Quaternary sediments are offset by 65 to 80 ft (20 to 25 m); younger sediments are offset by
41 about 23 to 26 ft (7 to 8 m). These offsets place the most recent movement along the fault at less
42 than 15,000 years ago (perhaps as recent as 10,000 years ago). The slip rate along this fault is
43 estimated to be less than 0.2 mm/yr. Recurrence intervals are estimated to be on the order of
44 25,000 to 50,000 years for the past 100,000 years (Pearthree 1998).
45
46



1

2 **FIGURE 8.2.7.1-3 General Terrain of the Proposed Bullard Wash SEZ**



1
 2 **FIGURE 8.2.7.1-4 Quaternary Faults, Volcanic Fields, and Earth Fissures in Arizona (USGS and**
 3 **AZGS 2010; USGS 2010a)**

1 From June 1, 2000, to May 31, 2010, only one earthquake was recorded within a 61-mi
2 (100-km) radius of the proposed Bullard Wash SEZ (USGS 2010b). The earthquake occurred
3 on May 9, 2009. It was located about 60 mi (100 km) east–northeast of the SEZ in Black
4 Canyon, just east of the Bradshaw Mountains, and registered a Richter magnitude of 3.1
5 (Figure 8.2.7.1-4). The largest earthquake in the region occurred on February 4, 1976, near
6 Prescott, Arizona, about 50 mi (80 km) northeast of the Bullard Wash SEZ (Figure 8.2.7.1-4).
7 The earthquake registered a magnitude (ML¹) of 5.2 (USGS 2010a).
8
9

10 **Liquefaction.** The proposed Bullard Wash SEZ lies within an area where the peak
11 horizontal acceleration with a 10% probability of exceedance in 50 years is between 0.03 and
12 0.04 g. Shaking associated with this level of acceleration is generally perceived as light to
13 moderate; the potential damage to structures is very light (USGS 2008). Given the low incidence
14 of earthquakes within a 61-mi (100-km) radius of the Bullard Wash SEZ and the very low
15 intensity of ground shaking estimated for the area, the potential for liquefaction in valley
16 sediments also is likely to be very low.
17
18

19 **Volcanic Hazards.** Extensive volcanic activity occurred in Arizona throughout the
20 Tertiary period, with the most recent activity occurring less than 4 million years ago, mainly
21 along the edge of the Colorado Plateau in northeastern Arizona (Figure 8.2.7.1-4). Over the past
22 15 million years, eruptions were predominantly composed of basalt. The nearest volcanic center
23 is the Sentinel volcanic field, about 105 mi (170 km) south–southeast of the proposed Bullard
24 Wash SEZ; basaltic lava flows erupted from volcanic vents in this area from about 3.3 to
25 1.3 million years ago (Wood and Kienle 1992). Currently, there is no evidence of volcanic
26 activity or unrest in southern Arizona (Fellows 2000). Lynch (1982) suggests that the next
27 eruption in Arizona would most likely occur in the San Francisco Mountain, Uinkaret, or
28 Pinacate volcanic fields and, because it likely would be of the strombolian type (basaltic lava
29 from a single vent with intermittent explosions), would cause little damage or disruption.
30
31

32 **Slope Stability and Land Subsidence.** The incidence of rock falls and slope failures can
33 be moderate to high along mountain fronts and can present a hazard to facilities on the relatively
34 flat terrain of valley floors like the Date Creek basin, if they are located at the base of steep
35 slopes. The risk of rock falls and slope failures decreases toward the flat valley center.
36
37

38 The Arizona Geological Survey has reviewed aerial and satellite imagery and conducted
39 on-the-ground investigations at 23 study areas to identify and map earth fissures with surface
40 expression. The study areas are within four Arizona counties (Pinal, Maricopa, Cochise, and
41 Pima) that are prone to fissuring (Shipman and Diaz 2008). Earth fissures and subsidence of
about 0.6 ft (0.2 m) have been identified within the Harquahala Plain (Maricopa County), about

¹ Richter scale magnitude (ML) was the original magnitude defined by Richter and Gutenberg for local earthquakes in 1935. It was based on the maximum amplitude recorded on a Wood-Anderson torsion seismograph but is currently calculated for earthquakes with magnitudes ranging from 2 to 6, using modern instruments with adjustments (USGS 2010b).

1 40 mi (64 km) due south of the proposed Bullard Wash SEZ (AGS 2010; Galloway et al. 1999)
2 (Figure 8.2.7.1-4). The fissures are the result of ground subsidence due to groundwater
3 overdrafts in the basin that have caused differential compaction in the underlying aquifer. Land
4 failure caused by subsidence and fissures in parts of Arizona has been significant enough to
5 damage buildings, roads, railroads, and sewer lines and necessitate changes in the planned route
6 of the Central Arizona Project aqueduct (Galloway et al. 1999). Subsidence in Date Creek basin
7 also is likely because of marked declines in groundwater levels since 1948 (by as much as 300 ft
8 [90 m] near Goodyear, according to Ninyo and Moore [2007]) as a result of the high rates of
9 irrigation pumpage in the basin.

10
11
12 **Other Hazards.** Other potential hazards at the proposed Bullard Wash SEZ include those
13 associated with soil compaction (restricted infiltration and increased runoff), expanding clay
14 soils (destabilization of structures), and hydro-compactable or collapsible soil (settlement).
15 Disturbance of soil crusts and desert pavement on soil surfaces may increase the likelihood of
16 soil erosion by wind.

17
18 Alluvial fan surfaces, such as those found within the Date Creek basin, can be the sites of
19 damaging high-velocity “flash” floods and debris flows during periods of intense and prolonged
20 rainfall. The nature of the flooding and sedimentation processes (e.g., stream flow versus debris
21 flow fans) will depend on specific morphology of the fan (National Research Council 1996).
22 Section 8.2.9.1.1 provides further discussion of flood risks within the Bullard Wash SEZ.

23 24 25 **8.2.7.1.2 Soil Resources**

26
27 Soils within the proposed Bullard Wash SEZ are sandy loams and gravelly sandy loams
28 typical of alluvial fan settings (Figure 8.2.7.1-5). Soil map units within the Bullard Wash SEZ
29 are described in Table 8.2.7.1-1. Parent material consists of fan alluvium from mixed sources.
30 Soils are characterized as deep and well-drained with moderate to high surface-runoff potential
31 and moderate to moderately rapid permeability. The natural soil surface is moderately suited for
32 roads, with a slight to moderate water erosion hazard when used as roads or trails. The
33 susceptibility to wind erosion is moderate, with as much as 86 tons (78 metric tons) of soil per
34 acre eroded by wind each year (NRCS 2010).

35
36 None of the soils within the Bullard Wash SEZ is rated as hydric.² Flooding of soils at
37 the site is not likely and occurs with a frequency of less than once in 500 years. Most of the soils
38 are not suitable for cultivation unless irrigated; only the Mohave sandy loam (covering about
39 19% of the site) is classified as prime farmland. The major crop in the region is alfalfa (forage)
40 (USDA 2010a; NRCS 2010).

41

² A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding (NRCS 2010).

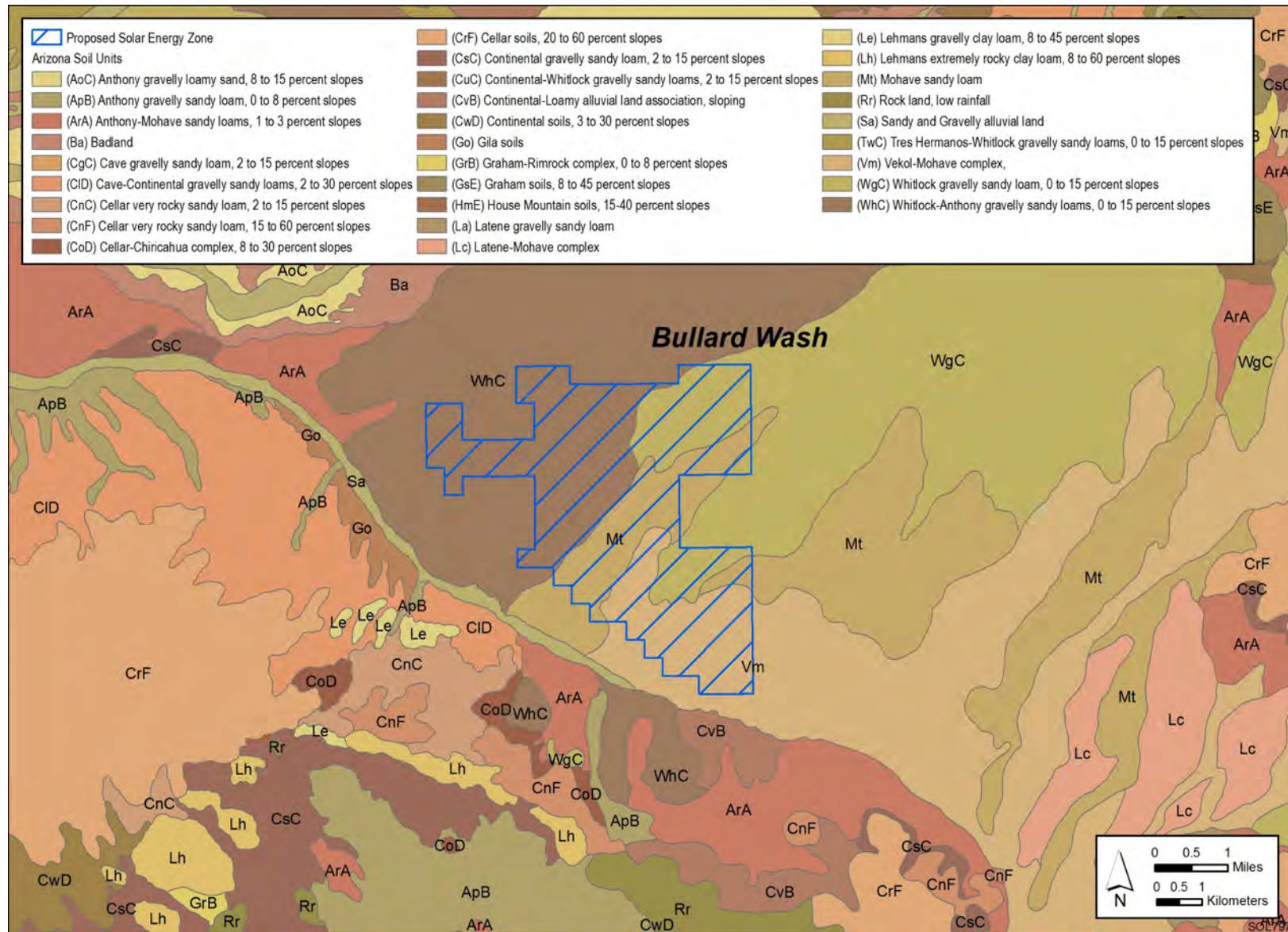


FIGURE 8.2.7.1-5 Soil Map for the Proposed Bullard Wash SEZ (NRCS 2008)

TABLE 8.2.7.1-1 Summary of Soil Map Units within the Proposed Bullard Wash SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential ^a	Wind Erosion Potential	Description	Area in Acres ^b (% of SEZ)
WgC	Whitlock-Anthony gravelly sandy loams (0 to 15% slopes)	Slight	Moderate (WEG 3) ^c	Consists of 60% Whitlock gravelly sandy loam and 30% Anthony gravelly sandy loam. Level to sloping soils on alluvial fans. Parent material is fan alluvium from mixed sources. Soils are very deep and well drained, with moderate surface runoff potential and moderate to moderately rapid permeability. Available water capacity is low to moderate. Moderate rutting hazard. Used for rangeland, wildlife habitat, and irrigated cropland.	2,744 (38)
Vm	Vekol-Mohave complex (0 to 3% slopes)	Moderate	Moderate (WEG 5)	Consists of 55% Vekol gravelly sandy loam, 35% Mojave sandy loam. Level to nearly level soils on alluvial fans and swales. Parent material is alluvium derived from granite and other sources. Soils are very deep and well drained, with high surface runoff potential (very slow infiltration rate) and slow to moderately slow permeability. Available water capacity is moderate to high. Severe rutting hazard. Used for rangeland, wildlife habitat, and irrigated cropland.	1,576 (22)
WgC	Whitlock gravelly sandy loam (0 to 15% slopes)	Slight	Moderate (WEG 5)	Level to sloping soils on alluvial fans. Parent material is alluvium from mixed sources. Soils are deep and well drained, with moderate surface runoff potential and moderate permeability. Available water capacity is low. Moderate rutting hazard. Used for rangeland, wildlife habitat, and irrigated cropland.	1,534 (21)
Mt	Mohave sandy loam (0 to 8% slopes)	Slight	Moderate (WEG 3)	Level to nearly level soils on alluvial fan terraces. Parent material is fan alluvium from mixed sources. Soils are very deep and well drained, with moderate surface runoff potential and moderately slow permeability. Available water capacity is high. Moderate rutting hazard. Used mainly for livestock grazing, wildlife habitat, and irrigated cropland. Prime farmland if irrigated. ^d	1,386 (19)

Footnotes on next page.

TABLE 8.2.7.1-1 (Cont.)

-
- ^a Water erosion potential rates the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K (whole soil; doesn't account for the presence of rock fragments) and represent soil loss caused by sheet or rill erosion where 50 to 75 percent of the surface has been exposed by ground disturbance. A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions. A rating of "severe" indicates that erosion is expected; loss of soil productivity and damage are likely and erosion control measures may be costly or impractical.
- ^b To convert acres to km², multiply by 0.004047.
- ^c WEG = wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and also take into account soil moisture, surface cover, soil surface roughness, wind velocity and direction, and the length of unsheltered distance (USDA 2004). Groups range in value from 1 (most susceptible to wind erosion) to 8 (least susceptible to wind erosion). The NRCS provides a wind erodibility index, expressed as an erosion rate in tons per acre per year, for each of the wind erodibility groups: WEGs 3, 86 tons per acre per year; and WEG 5, 56 tons per acre per year.
- ^d Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses.

Source: NRCS (2010).

1 **8.2.7.2 Impacts**
2

3 Impacts on soil resources would occur mainly as a result of ground-disturbing activities
4 (e.g., grading, excavating, and drilling), especially during the construction phase of a solar
5 project. These activities include soil compaction, soil horizon mixing, soil erosion and deposition
6 by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. Such
7 impacts are common to all utility-scale solar energy developments in varying degrees and are
8 described in more detail for the four phases of development in Section 5.7 .1.
9

10 Because impacts on soil resources result from ground-disturbing activities in the project
11 area, soil impacts would be roughly proportional to the size of a given solar facility, with larger
12 areas of disturbed soil having a greater potential for impacts than smaller areas (Section 5.7.2).
13 The magnitude of impacts would also depend on the types of components built for a given
14 facility since some components would involve greater disturbance and would take place over a
15 longer time frame.
16

17
18 **8.2.7.3 SEZ-Specific Design Features and Design Feature Effectiveness**
19

20 No SEZ-specific design features were identified for soil resources at the proposed Bullard
21 Wash SEZ. Implementing the programmatic design features described under both Soils and Air
22 Quality in Appendix A, Section A.2.2., as required under BLM's proposed Solar Energy
23 Program, would reduce the potential for soil impacts during all project phases.
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1 **8.2.8 Minerals (Fluids, Solids, and Geothermal Resources)**
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4 **8.2.8.1 Affected Environment**
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6 As of July 27, 2010, there are no locatable mining claims within the proposed Bullard
7 Wash SEZ, although there are numerous historical lode and placer claims that have been closed
8 within the SEZ (BLM and USFS 2010a). The public land within the SEZ has been closed to
9 locatable mineral entry since June 2009, pending the outcome of this solar energy PEIS. There
10 are no active oil and gas leases in the area. However, most of the area in and around the SEZ has
11 been leased in the past, but the leases have expired (BLM and USFS 2010b). The area remains
12 open for discretionary mineral leasing for oil and gas and other leasable minerals, and for
13 disposal of salable minerals. There is no active geothermal leasing or development in or near the
14 SEZ, nor has the area been leased previously (BLM and USFS 2010b).
15

16
17 **8.2.8.2 Impacts**
18

19 If the area is identified as a solar energy zone, it would continue to be closed to all
20 incompatible forms of mineral development. For the purpose of this analysis, it was assumed
21 that future development of oil and gas resources, should any be found, would continue to be
22 possible, since such development could occur with directional drilling from outside the SEZ.
23 Since the SEZ does not contain existing mining claims, it was also assumed that there would be
24 no future loss of locatable mineral production. The production of common minerals, such as sand
25 and gravel and mineral materials used for road construction or other purposes, might take place
26 in areas not directly developed for solar energy production.
27

28 The SEZ has had no history of development of geothermal resources. For that reason, it
29 is not anticipated that solar development would adversely affect the development of geothermal
30 resources.
31

32
33 **8.2.8.3 SEZ-Specific Design Features and Design Feature Effectiveness**
34

35 No SEZ-specific design features are required to protect mineral resources. Implementing
36 the programmatic design features described in Appendix A, Section A.2.2, as required under
37 BLM's proposed Solar Energy Program, would provide adequate mitigation for impacts on
38 mineral resources.
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1 **8.2.9 Water Resources**

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4 **8.2.9.1 Affected Environment**

5
6 The proposed Bullard Wash SEZ is located within the Bill Williams River Basin
7 subbasin of the Lower Colorado Hydrologic Region (USGS 2010a) and the Basin and Range
8 characterized by intermittent mountain ranges and desert valleys (Robson and Banta 1995). The
9 proposed SEZ has surface elevations ranging between 2,320 and 2,590 ft (707 and 789 m). The
10 proposed Bullard Wash SEZ is located in a valley bounded by several mountain ranges,
11 including the Black Mountains to the north, the Date Creek Mountains to the northeast, and the
12 Harcuvar Mountains to the southwest (Figure 8.2.9.1-1). Annual average precipitation is
13 estimated to be 10 to 14 in./yr (25 to 36 cm/yr) in the vicinity of the Bullard Wash SEZ and
14 varies between 6 and 22 in./yr (15 and 56 cm/yr) in other parts of the basin, with higher
15 precipitation occurring at higher elevations (ADWR 2010a). Average evaporation rates are
16 estimated to be 105 in./yr (267 cm/yr) (Cowherd et al. 1988).
17
18

19 **8.2.9.1.1 Surface Waters (Including Drainages, Floodplains, and Wetlands)**

20
21 There are no perennial surface water bodies on the proposed Bullard Wash SEZ. Bullard
22 Wash flows to the northwest along the southwest side of the SEZ and ends at Alamo Lake
23 (Figure 8.2.9.1-1). The proposed SEZ is located entirely within the Bullard Wash watershed.
24 Date Creek is north of the SEZ and flows to the east and northeast toward the Santa Maria River,
25 which also flows into Alamo Lake. Both Bullard Wash and Date Creek are ephemeral streams
26 that convey runoff in response to large rainfall events in the vicinity of the SEZ. Numerous
27 ephemeral dry washes occur within the SEZ, generally flowing to the southwest, to Bullard
28 Wash. These dry washes typically contain water for short periods during or following
29 precipitation events and include temporarily flooded areas. Portions of Date Creek upstream of
30 the SEZ are known to be intermittent. Date Creek was gauged from 1939 to 1943 just north of
31 the SEZ, encompassing a drainage area of 81,280 acres (329 km²). The largest daily flow
32 recorded was 589 cfs (16.7 m³/s), and the largest annual flow was 7,674 ac-ft (9.4 million m³)
33 (in 1941); in 1942, no flow was recorded at the gauge. Alamo Lake is a reservoir located
34 upstream of the Alamo Dam, operated by the U.S. Army Corps of Engineers. The maximum
35 storage capacity of Alamo Lake is 1.4 million ac-ft (1.7 billion m³), and it has an area of
36 12,096 acres (49 km²). In addition to Bullard Wash, the Santa Maria River and the Sandy River
37 flow into Alamo Lake. The Bill Williams River is a perennial stream that flows downstream
38 of Alamo Lake and drains into the Colorado River approximately 31 mi (50 km) west of
39 Alamo Lake.
40

41 Flood hazards within the SEZ include areas within the 100-year floodplain (Zone A) and
42 the 100 to 500-year floodplain (Zone X) (FEMA 2009). The 100-year flood zones are within
43 four tributary washes that extend northeast from Bullard Wash. The rest of the SEZ is within the
44 100 to 500-year floodplain area. Within the flood zones, intermittent flooding may occur with
45 temporary ponding and erosion. Three small, isolated wetland areas have been identified within
46 the SEZ (USFWS 2009). A number of other small wetland areas in the vicinity of the SEZ have
47 been mapped, see Section 8.2.10 for more information.

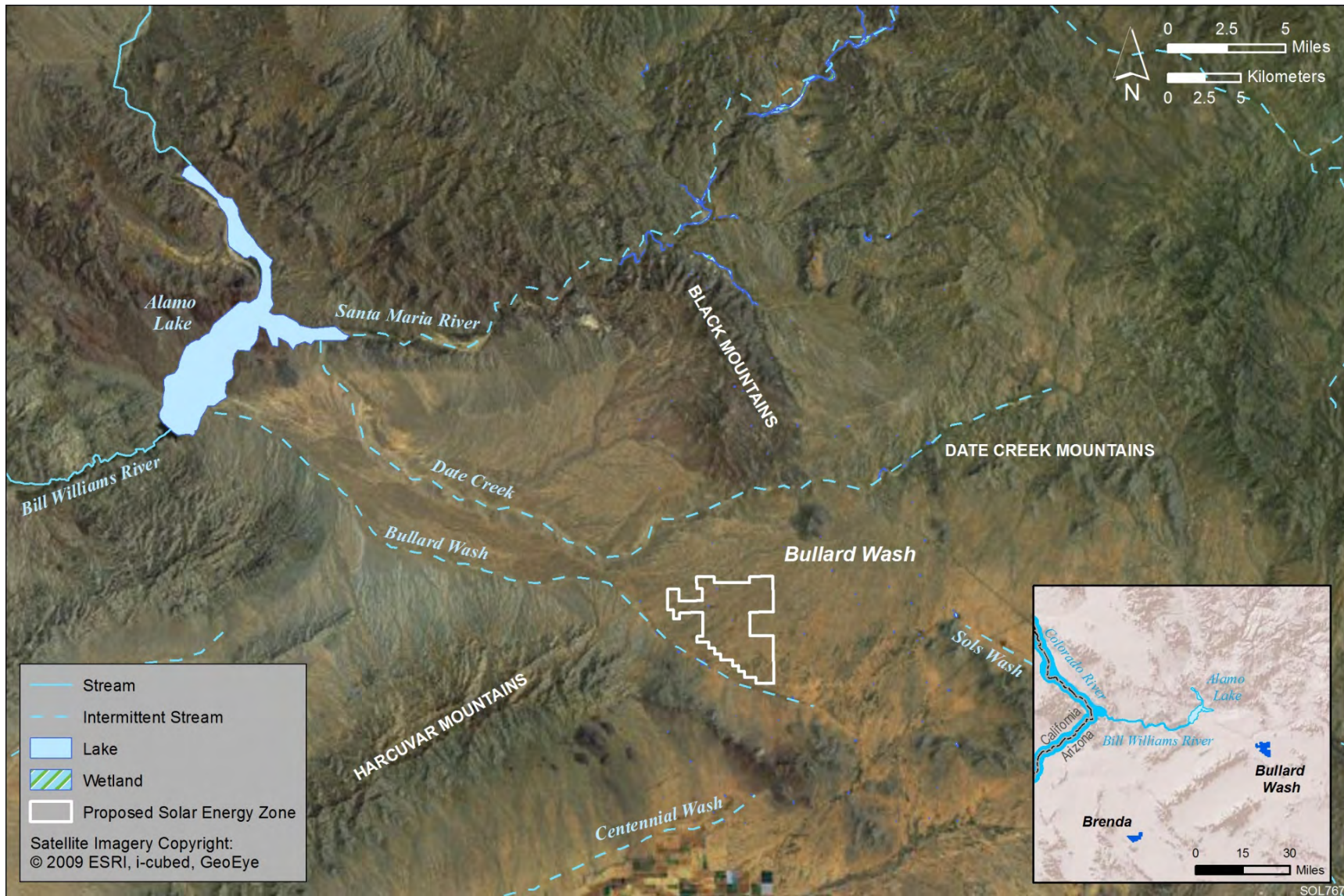


FIGURE 8.2.9.1-1 Surface Water Features near the Proposed Bullard Wash SEZ

1 **8.2.9.1.2 Groundwater**
2

3 The proposed Bullard Wash SEZ is located within the Date Creek subbasin of the Bill
4 Williams groundwater basin. Groundwater in the Bill Williams basin occurs primarily in alluvial
5 deposits, volcanic rocks, and basin-fill deposits (ADWR 2010a). Bill Williams basin is broken
6 up into the following planning-area subbasins by the ADWR: Clara Peak, Alamo Reservoir,
7 Burro Creek, Santa Maria, and Skull Valley. The Bullard Wash SEZ is located in the
8 southeastern portion of the Alamo Reservoir subbasin (termed Date Creek subbasin by USGS
9 reports), where groundwater flows from the south to the northwest toward the Bill Williams
10 River drainage (ADWR 2010a). The main water-bearing unit near the Bullard Wash SEZ is the
11 basin fill, which has been estimated to be more than 5,000 ft thick in the area (ADWR 2010b).
12 In the Date Creek subbasin of the Bill Williams basin, groundwater surface elevations range
13 from 1,785 to 1,790 ft (544 to 545 m) (USGS 2010b; well numbers 340852113122501,
14 341508113203801, 340340113364201, and 340333113363701). Depth to water measurements
15 taken between 1974 and 2006 range from 508 to 649 ft (155 to 198 m) below ground surface
16 (USGS 2010b; well numbers 340852113122501, 341508113203801, 340340113364201,
17 and 340333113363701).
18

19 The ADWR has estimated that there are between 10 million and 23 million ac-ft
20 (12 billion to 28 billion m³) of stored water available in the entire Bill Williams basin; in the
21 Date Creek subbasin, where the Bullard Wash SEZ is located, the estimated amount of water
22 stored in a predevelopment condition was 8 million ac-ft (9.9 billion m³) (ADWR 2010a;
23 Freethy and Anderson 1986). Groundwater recharge has been estimated to be 32,000 ac-ft/yr
24 (39 million m³/yr) from recharge from stream flow and mountain front precipitation within the
25 entire Bill Williams basin, but only 10,000 ac-ft/yr (12 million m³/yr) in the Date Creek subbasin
26 (ADWR 2010a; Freethy and Anderson 1986). Recharge from precipitation on the basin floor
27 is expected to be small because of low precipitation (ADWR 2010a). In a predevelopment
28 condition, it was estimated that over half of the recharge was lost to evapotranspiration in the
29 basin and the rest was estimated to provide base flow to streams in the basin (Freethy and
30 Anderson 1986).
31

32 Groundwater inflows from the adjacent Big Sandy basin to the north to the Date Creek
33 subbasin are estimated to be less than 1,000 ac-ft/yr (1.2 million m³/yr) and are on the same
34 order as estimated outflows to the adjacent Havasu Lake basin to the west (Freethy and
35 Anderson 1986). In a comprehensive report about the regional aquifer system in south-central
36 Arizona, Anderson (1995) indicated that groundwater was not the primary method of water flow
37 into the Havasu Lake basin, which contains the Bill Williams River. Interbasin flow in this area
38 is estimated to occur as surface water flow (Anderson 1995). Accordingly, the aquifer in this
39 area is not considered part of the Colorado River flow system (Anderson 1995).
40

41 Data collected from 1974 to 2006 indicate that groundwater levels have fluctuated but
42 generally increased in the Date Creek subbasin because of decreased pumping in the basin since
43 the late 1980s, when pumping rates started to decline (ADWR 2010a). A rebound of water levels
44 ranging from 5.5 to 53 ft (1.7 to 16 m) has occurred in four of the five wells analyzed in the
45 vicinity of the proposed Bullard Wash SEZ (USGS 2010b; wells 341508113203801,
46 340852113122501, 341153113412301, 340333113363701, and 342835113391301).
47

1 Groundwater quality samples reported for the Bill Williams basin in the vicinity of
2 the proposed Bullard Wash SEZ have found total dissolved solids (TDS) concentrations to
3 be between 230 and 250 mg/L within the basin-fill (USGS 2010b; wells 340852113122501,
4 341151113101201, 341227113052901, and 40955113235401). Concentrations of arsenic and
5 fluoride that exceed drinking water quality standards (EPA 2009d) have been found in samples
6 taken in the northwestern part of the Alamo Reservoir subbasin of the Bill Williams basin.
7 Samples in the vicinity of the Bullard Wash SEZ have been found to have low concentrations
8 of fluoride, but have not been tested for arsenic concentrations (USGS 2010b; wells
9 340852113122501, and 341227113052901). Throughout the Bill Williams basin, water quality
10 samples taken between 1979 and 2003 from mines, wells, and springs indicated that constituents
11 in a total of 60 samples exceeded drinking water standards; specifically, concentrations of
12 arsenic, cadmium, fluoride, lead, mercury, nitrate, TDS, and radionuclides were found to
13 exceed drinking water standards in various locations throughout the basin (ADWR 2010a).
14
15

16 ***8.2.9.1.3 Water Use and Water Rights Management***

17

18 In 2005, water withdrawals from surface waters and groundwater in Maricopa County
19 were 1,577,316 ac-ft/yr (1.9 billion m³/yr), of which 84% came from groundwater and
20 16% came from surface water. The largest water use category was irrigation (81%), at
21 1,271,515 ac-ft/yr (1.56 billion m³/yr). Public supply/domestic water uses accounted for
22 258,197 ac-ft/yr (318 million m³/yr), with thermoelectric water uses on the order of
23 26,431 ac-ft/yr (32 million m³/yr), aquaculture accounting for 1,816 ac-ft/yr (2.2 million m³/yr),
24 livestock at 5324 ac-ft/yr (6.5 million m³/yr), and mining with 7,857 ac-ft/yr (9.6 million m³/yr)
25 (Kenny et al. 2009). Between 2001 and 2005, 5,650 ac-ft/yr (7 million m³/yr) of water was used
26 in the Bill Williams basin, of which 91% came from groundwater and 9% came from surface
27 water (ADWR 2010a). The primary use for groundwater in the basin is irrigation (80%), with
28 smaller amounts used for public supply (12%) and for industrial purposes (6%) (ADWR 2010a).
29 Surface water diversions are from the Bill Williams River and are used primarily for municipal
30 supply (ADWR 2010a).
31

32 Arizona water law is based on the doctrine of prior appropriation. However, water laws
33 in Arizona are based on a bifurcated system in which surface water and groundwater rights are
34 administered and assessed separately. The state of Arizona has four main sources of water:
35 Colorado River water, surface water separate from the Colorado River, groundwater, and
36 treated effluent. Rights for these four sources are assessed and administered separately:
37 Colorado River water is regulated under the Law of the River; surface water is based on prior
38 appropriation; and groundwater rights are handled on a region-by-region basis (BLM 2001).
39 Effluent is not available for use until it takes on the characteristics of surface water through
40 treatment (ADWR 2010e). The ADWR is the agency responsible for the conservation and
41 distribution of water in the state. It is also responsible for the administration and assessment of
42 novel water rights and transfer of existing water rights and applications. The agency's broad goal
43 is the security of long-term dependable water supplies for the state, which is the main factor in
44 the assessment of water right applications (ADWR 2010f).
45

1 Upon completion of an application for water rights, the ADWR has three main criteria for
2 assessing the application: whether the proposed water right will conflict with more senior water
3 rights, whether the proposed right will pose a threat to public safety, and whether the proposed
4 right will be detrimental to the interests and welfare of the general public (BLM 2001). In
5 general, surface water rights are assessed solely upon the criteria above, but they may also be
6 subject to certain management plans in specific areas put into effect by the ADWR. Unlike the
7 majority of groundwater rights that are bound to the land they occupy, users of surface water
8 rights have the option to change location of the water right but not the beneficial use (a change of
9 beneficial use application would need to be submitted). In order to change a surface water right's
10 location a "sever and transfer" permit needs to be approved by the ADWR and the governing
11 body of the irrigation district or water users council of the proposed new location of the surface
12 water right. Evaluations of "sever and transfer" permits follow the same general evaluation
13 guidelines as new surface water rights, and the proposed new location of the right after the
14 transfer is treated as a new surface water right. The new surface water right must not exceed the
15 old one in annual water use (ADWR 2010e).

16
17 Arizona has rights to 2.8 million ac-ft of Colorado River water annually, which is further
18 subdivided into allocations for both general Colorado River water users and Central Arizona
19 Project (CAP) users (ADWR 2010h). CAP is a system of water delivery canals, aqueducts, and
20 pumping stations that deliver 1.5 million ac-ft/yr of Colorado River water from Lake Havasu to
21 Pima, Pinal and Maricopa counties annually (CAP 2010). The flows of the Colorado River are
22 variable and thus the water resource availability is variable from year to year.

23
24 Because of historic groundwater overdraft, where groundwater recharge is exceeded by
25 discharge (in some places groundwater overdraft is in excess of 700,000 ac-ft/yr
26 [863 million m³/yr]), the Ground Water Management Code was put into effect in 1980 (ADWR
27 2010i; ADWR 1999). The Code describes three main goals for the state regarding the
28 management of groundwater: control of severe overdraft, allocation of the limited water
29 resources of the state, and enhancement of the state's groundwater resources using water supply
30 development (BLM 2001). Arizona's groundwater management laws are separated by using a
31 three-tier system based on the Code, in which proposed applications are evaluated with an
32 increasing level of scrutiny. The lowest level of management includes provisions that apply
33 statewide; INAs have an intermediate level of management; and Active Management Areas
34 (AMAs) have the highest level of management with the most restrictions and provisions. Within
35 an AMA or INA, a groundwater permit is required (BLM 2001). There are currently five AMAs
36 and three INAs in the state, each of which has its own specific rules and regulations regarding
37 the appropriation of groundwater (ADWR 2010g). In locations outside of designated AMAs and
38 INAs, a permit is not necessary to withdraw groundwater (BLM 2001). Use of this groundwater,
39 however, requires the filing of a notice of intent to drill with the ADWR.

40
41 Recently, the ADWR (2010e) created guidelines regarding the appropriation of water
42 for solar generating facilities, specifically detailing what information needs to be submitted for
43 permit evaluation. Information that is required to be submitted includes the proposed method of
44 power generation, the proposed amount of water to be consumed, the point of diversion, and to
45 what or whom the power is to be distributed. To secure water rights for a solar facility to be
46 located within an AMA, the applicant must demonstrate that there is an "assured water supply"

1 for the life of the project. The ADWR then makes a decision based on whether the
2 proposed water right will be detrimental to public welfare and general conservation of
3 water (ADWR 2010e).

4
5 Groundwater within the Bullard SEZ is located in the Bill Williams basin, which is
6 part of the Upper Colorado River Planning Area (ADWR 2010a). The Colorado River is over-
7 allocated and likely would not contribute to surface water resources available for use by solar
8 development for the Bullard Wash SEZ (Lavelle 2006). Since the Bill Williams basin is not
9 included in either an AMA or INA, it is legal to pump groundwater without a permit; however
10 a Notice of Intent to Drill must be reported with the ADWR (ADWR 2010c).

11 12 13 **8.2.9.2 Impacts**

14
15 Potential impacts on water resources related to utility-scale solar energy development
16 include direct and indirect impacts on surface waters and groundwater. Direct impacts occur at
17 the place of origin and at the time of the proposed activity, while indirect impacts occur away
18 from the place of origin or later in time. Impacts on water resources considered in this analysis
19 are the result of land disturbance activities (construction, final developed site plan, and off-site
20 activities such as road and transmission line construction) and water use requirements for solar
21 energy technologies that take place during the four project phases: site characterization,
22 construction, operations, and decommissioning/reclamation. Both land disturbance and
23 consumptive water use activities can affect groundwater and surface water flows, cause
24 drawdown of groundwater surface elevations, modify natural drainage pathways, obstruct natural
25 recharge zones, and alter surface water-wetland-groundwater connectivity. Water quality can
26 also be degraded through the generation of wastewater, chemical spills, increased erosion and
27 sedimentation, and increased salinity (e.g., by excessive withdrawal from aquifers).

28 29 30 ***8.2.9.2.1 Land Disturbance Impacts on Water Resources***

31
32 Impacts related to land disturbance activities are common to all utility-scale solar
33 energy developments, which are described in more detail for the four phases of development in
34 Section 5.9.1; these impacts will be minimized through the implementation of programmatic
35 design features described in Appendix A, Section A.2.2. Land disturbance impacts in the vicinity
36 of the Bullard Wash SEZ could potentially affect natural groundwater recharge and discharge
37 properties. Tributary washes within the Bullard Wash SEZ convey runoff to Bullard Wash
38 during major storm events, as evident from channel erosion and sedimentation patterns.
39 Alterations to these systems could enhance erosion processes, disrupt groundwater recharge,
40 change flow quantities to Bullard Wash, and negatively affect plant and animal habitats
41 associated with the ephemeral channels.

1 **8.2.9.2.2 Water Use Requirements for Solar Energy Technologies**
2
3

4 **Analysis Assumptions**
5

6 A detailed description of the water use assumptions for the four utility-scale solar energy
7 technologies (parabolic trough, power tower, dish engine, and PV systems) is presented in
8 Appendix M. Assumptions regarding water use calculations specific to the proposed Bullard
9 Wash SEZ include the following:

- 10
- 11 • On the basis of a total area of 7,239 acres (29.2 km²), it is assumed that one
12 solar project would be constructed during the peak construction year;
 - 13
 - 14 • Water needed for making concrete would come from an off-site source;
 - 15
 - 16 • The maximum land disturbance for an individual solar facility during the peak
17 construction year is 3,000 acres (12 km²);
 - 18
 - 19 • Assumptions on individual facility size and land requirements (Appendix M),
20 along with the assumed number of projects and maximum allowable land
21 disturbance, results in the potential to disturb up to 41% of the SEZ total area
22 during the peak construction year; and
 - 23
 - 24 • Water use requirements for hybrid cooling systems are assumed to be on the
25 same order of magnitude as those using dry cooling (see Section 5.9.2.1).
26

27

28 **Site Characterization**
29

30 During site characterization, water would be used mainly for controlling fugitive dust and
31 for providing the workforce potable water supply. Impacts on water resources during this phase
32 of development are expected to be negligible since activities would be limited in area, extent,
33 and duration; water needs could be met by trucking water in from an off-site source.
34

35

36 **Construction**
37

38 During construction, water would be used mainly for controlling fugitive dust and the
39 workforce potable water supply. Because there are no significant surface water bodies on the
40 proposed Bullard Wash SEZ, the water requirements for construction activities could be met
41 by either trucking water to the sites or using on-site groundwater resources.
42

43 Water requirements for dust suppression and potable water supply during the peak
44 construction year are shown in Table 8.2.9.2-1 and could be as high as 1,816 ac-ft
45 (2.2 million m³). The assumptions underlying these estimates for each solar energy technology
46 are described in Appendix M. Groundwater wells would have to yield up to an estimated

TABLE 8.2.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Bullard Wash SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements ^a				
Fugitive dust control (ac-ft) ^{b,c}	1,199	1,798	1,798	1,798
Potable supply for workforce (ac-ft)	74	45	19	9
Total water use requirements (ac-ft)	1,228	1,816	1,805	1,802
Wastewater generated				
Sanitary wastewater (ac-ft)	74	45	19	9

^a Assumptions of water use for fugitive dust control, potable supply for workforce, and wastewater generation are presented in Table M.9-1 (Appendix M).

^b Fugitive dust control estimation assumes a local pan evaporation rate of 105 in./yr (267 cm/yr) (Cowherd et al. 1988).

^c To convert ac-ft to m³, multiply by 1,234.

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1,140 gal/min (4,320 L/min) to meet the estimated construction water requirements. This yield is within the range of producing wells in the Bill Williams basin and is typical of well yields of small- to medium-sized farms in Arizona (ADWR 2010a; USDA 2009b). The availability of groundwater and the impacts of groundwater withdrawal would need to be assessed during the site characterization phase of a solar development project. In addition to groundwater withdrawals, up to 74 ac-ft (92,000 m³) of sanitary wastewater would be generated annually and would need to be either treated on-site or sent to an off-site facility. Groundwater quality in the vicinity of the SEZ would need to be tested to verify the quality would comply with drinking water standards.

Operations

Water would be required for mirror/panel washing, the workforce potable water supply, and cooling during operations. Cooling water is required only for the parabolic trough and power tower technologies. Water needs for cooling are a function of the type of cooling used (dry, wet, hybrid). Further refinements to water requirements for cooling would result from the percentage of time the option was employed (30 to 60% range assumed) and the power of the system. The differences between the water requirements reported in Table 8.2.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per megawatt. As a result, the water usage for the more energy-dense parabolic trough technology is estimated to be almost twice as large as that for the power tower technology.

Water use requirements among the solar energy technologies are a factor of the full build-out capacity for the SEZ, as well as assumptions on water use and technology operations discussed in Appendix M. Table 8.2.9.2-2 lists the quantities of water needed for mirror/panel

TABLE 8.2.9.2-2 Estimated Water Requirements during Operations at the Proposed Bullard Wash SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW) ^{a,b}	1,158	643	643	643
Water use requirements				
Mirror/panel washing (ac-ft/yr) ^{c,d}	579	322	322	32
Potable supply for workforce (ac-ft/yr)	16	7	7	0.7
Dry cooling (ac-ft/yr) ^e	232–1,158	129–643	NA ^f	NA
Wet cooling (ac-ft/yr) ^e	5,212–16,794	2,896–9,330	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	329	33
Dry-cooled technologies (ac-ft/yr)	827–1,754	458–972	NA	NA
Wet-cooled technologies (ac-ft/yr)	5,807–17,390	3,225–9,659	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr) ^g	329	183	NA	NA
Sanitary wastewater (ac-ft/yr)	16	7	7	0.7

^a Land area for parabolic trough was estimated at 5 acres/MW (0.02 km²/MW); land area for the power tower, dish engine, and PV technologies was estimated at 9 acres/MW (0.04 km²/MW).

^b Water needs are linearly related to power. Water usage for any other size project can be estimated by using multipliers provided in Table M.9-2 (Appendix M).

^c Value assumes a usage rate of 0.5 ac-ft/yr/MW for mirror washing for parabolic trough, power tower, and dish engine technologies and a rate of 0.05 ac-ft/yr/MW for panel washing for PV systems.

^d To convert ac-ft to m³, multiply by 1,234.

^e Dry-cooling value assumes 0.2 to 1.0 ac-ft/yr per MW and wet-cooling value assumes 4.5 to 14.5 ac-ft/yr per MW (range in these values represents 30 and 60% operating times) (DOE 2009).

^f NA = not applicable.

^g Value scaled from 250-MW Beacon Solar project with an annual discharge of 44 gpm (167 L/min) (AECOM 2009). Blowdown estimates are relevant to wet cooling only.

1
2
3 washing, potable water supply, and cooling activities for each solar energy technology. At full
4 build-out capacity, the estimated total water use requirements for non-cooling technologies
5 (i.e., technologies that do not use water for cooling) during operations are 33 and 329 ac-ft/yr
6 (40,700 and 406,000 m³/yr) for the PV and dish engine technologies, respectively. For
7 technologies that use water for cooling (i.e., parabolic trough and power tower), total water
8 needs range from 458 ac-ft/yr (0.6 million m³/yr) (power tower for an operating time of 30%
9 and using dry cooling) to 17,390 ac-ft/yr (21.5 million m³/yr) (parabolic trough for an operating
10 time of 60% and using wet cooling). Operations would generate up to 16 ac-ft/yr (20,000 m³/yr)
11 of sanitary wastewater; in addition, for wet-cooled technologies, 183 to 329 ac-ft/yr (226,000 to
12 406,000 m³/yr) of cooling system blowdown water would need to be either treated on-site or sent

1 to an off-site facility. Any on-site treatment of wastewater would have to ensure that treatment
2 ponds are effectively lined in order to prevent any groundwater contamination.

3
4 Water demands during operations would most likely be met by withdrawing groundwater
5 from wells constructed on-site. Non-cooled technologies (i.e., PV system and dish engine) would
6 require 21 gal/min (77 L/min) and 200 gal/min (760 L/min), respectively. Cooled technologies
7 (i.e., parabolic trough and power tower) would require well yields between 280 and
8 1,100 gal/min (1,100 and 4,100 L/min) for dry cooling, and between 2,000 and 11,000 gal/min
9 (7,600 and 41,000 L/min) for wet cooling. The required well yields for dry cooling are within the
10 range of well yields within the Bill Williams basin; wet-cooling water demands would mostly
11 exceed the average annual yield for a single well within the basin. For wet cooling, multiple
12 wells could be used. Water demands for non-cooled technologies are substantially less than those
13 for cooled technologies.

14
15 Water demands for technologies that require wet cooling are significant compared to
16 water use in the Bill Williams basin. For the Bullard Wash SEZ, estimated water requirements
17 for wet cooling are equivalent to a factor of 1 to 4 times the annual water withdrawal from the
18 basin (ADWR 2010a). The estimated recharge in the basin (32,000 ac-ft/yr [39 million m³/yr])
19 is much larger than the water demand, but the portion of the basin that contains the SEZ was
20 estimated to have a recharge of only 10,000 ac-ft/yr (12 million m³/yr). The estimated water
21 requirements for wet cooling are equivalent to 29 to 170% of the annual recharge for the Date
22 Creek portion of the Bill Williams basin. Based on the information presented here, wet cooling
23 for the full build-out scenario is not deemed feasible for the Bullard Wash SEZ. To the extent
24 possible, facilities using dry cooling should implement water conservation practices to limit
25 water needs.

26
27 The availability of water rights and the impacts associated with groundwater withdrawals
28 would need to be assessed during the site characterization phase of a proposed solar project.
29 Less water would be needed for any of the four solar technologies if the full build-out capacity
30 was reduced. The analysis of water use for the various solar technologies assumed a single
31 technology for full build-out. Water use requirements for development scenarios that assume
32 a mixture of solar technologies can be estimated by using water use factors described in
33 Appendix M.9.

34
35 In addition, the sustainable yield has not been assessed for the basin, and thus the impacts
36 of groundwater withdrawals on aquifer drawdown and potentially on land subsidence would
37 need to be investigated. These indirect impacts could disturb regional groundwater flow patterns
38 and recharge patterns, potentially affecting ecological habitats (see discussion in Section 8.2.10).
39 Groundwater quality in the vicinity of the SEZ would need to be tested to verify the quality
40 would comply with drinking water standards.

41 42 43 **Decommissioning/Reclamation**

44
45 During decommissioning/reclamation, all surface structures associated with the
46 solar project would be dismantled, and the Bullard Wash SEZ would be reclaimed to its

1 pre-construction state. Activities and water needs during this phase would be similar to those
2 during the construction phase (dust suppression and potable supply for workers), and may also
3 include water to establish vegetation in some areas. However, the total volume of water needed
4 is expected to be less. Because quantities of water needed during the decommissioning/
5 reclamation phase would be less than those for construction, impacts on surface and groundwater
6 resources also would be less.

8.2.9.2.3 *Off-Site Impacts: Roads and Transmission Lines*

11 The proposed Bullard Wash SEZ is located approximately 5 mi (8 km) from existing
12 transmission lines and 5 mi (8 km) from an existing road (State Route 71), as described in
13 Section 8.2.1.2. Impacts associated with the construction of roads and transmission lines
14 primarily deal with water use demands for construction, water quality concerns relating to
15 potential chemical spills, and land disturbance effects on the natural hydrology. Water needed
16 for road modification and transmission line construction activities (e.g., for soil compaction,
17 dust suppression, and potable supply for workers) could be trucked to the construction area
18 from an off-site source. As a result, water use impacts would be negligible. Impacts on surface
19 water and groundwater quality resulting from spills would be minimized by implementing the
20 mitigation measures described in Section 5.9.3 (e.g., cleaning up spills as soon as they occur).
21 Ground-disturbing activities that have the potential to increase sediment and dissolved solid
22 loads in downstream waters would be conducted following the mitigation measures outlined in
23 Section 5.9.3 to minimize impacts associated with alterations to natural drainage pathways and
24 hydrologic processes.

8.2.9.2.4 *Summary of Impacts on Water Resources*

29 The impacts on water resources associated with developing a utility-scale solar facility in
30 the proposed Bullard Wash SEZ are associated with land disturbance effects on hydrology, water
31 use requirements for the various solar energy technologies, and water quality issues. Impacts
32 relating to water use requirements vary depending on the type of solar technology built and, for
33 technologies using cooling systems, the type of cooling (wet, dry, or hybrid) employed. Water
34 requirements would be greatest for wet-cooled parabolic trough and power tower facilities. Dry
35 cooling reduces water use requirements by approximately a factor of 10 compared with wet
36 cooling. PV requires the least amount of water among the solar energy technologies. The
37 estimates of groundwater recharge, discharge, underflow from adjacent basins, and historical
38 data on groundwater extractions and groundwater surface elevations suggest that there is not
39 enough water available to support the water-intensive technologies, such as those using wet
40 cooling for the full build-out scenario.

42 Because the Bullard Wash SEZ is not located within a designated AMA or INA, no
43 groundwater permit would be required for groundwater supply wells. However, an application to
44 drill would have to be submitted to the state, and its groundwater extraction plans would have to
45 be approved by the ADWR. The portion of the basin that contains the SEZ (the Date Creek
46 basin) was estimated to have a recharge of only 10,000 ac-ft/yr (12 million m³/yr). In addition,

1 the sustainable yield has not been assessed for the basin, and thus impacts of groundwater
2 withdrawals on aquifer drawdown and potentially land subsidence would need to be investigated.
3 If groundwater in the local Date Creek basin is not well connected to the rest of the Bill Williams
4 basin, local groundwater extraction could significantly lower the water table, decrease the
5 volume of stored water, change the direction of groundwater flow, and produce land subsidence.
6 Land subsidence in the basins of Arizona is generally caused by compaction of the alluvium
7 caused by a lowering of the water table. As the water table declines, pores in the alluvium once
8 held open by water pressure are no longer supported and collapse. Measurements of land
9 subsidence in the Bill Williams basin are not currently available.

10
11 Land disturbance activities can cause localized erosion and sedimentation issues, as well
12 as altering groundwater recharge and discharge processes. It is likely that Bullard Wash and its
13 tributaries provide significant recharge to the basin in the vicinity of the SEZ and land
14 disturbance activity could significantly impact groundwater recharge in the basin. Land
15 disturbance within the SEZ could impact channel erosion and sedimentation patterns in Bullard
16 Wash and the ephemeral washes that are present within the SEZ.

17 18 19 **8.2.9.3 SEZ-Specific Design Features and Design Feature Effectiveness**

20
21 Implementing the programmatic design features described in Appendix A, Section A.2.2,
22 as required under BLM's proposed Solar Energy Program, will mitigate some impacts on water
23 resources. Programmatic design features would focus on coordinating with federal, state, and
24 local agencies that regulate the use of water resources to meet the requirements of permits and
25 approvals needed to obtain water for development, and conducting hydrological studies to
26 characterize the aquifer from which groundwater would be obtained (including drawdown
27 effects, if a new point of diversion is created). The greatest consideration for mitigating water
28 impacts would be in the selection of solar technologies. The mitigation of impacts would be
29 best achieved by selecting technologies with low water demands.

30
31 Proposed design features specific to the proposed Bullard Wash SEZ include the
32 following:

- 33
34 • Wet-cooling options would not be feasible; other technologies should
35 incorporate water conservation measures;
 - 36
37 • During site characterization, hydrologic investigations would need to identify
38 100-year floodplains and potential jurisdictional water bodies subject to Clean
39 Water Act Section 404 permitting. Siting of solar facilities and construction
40 activities should avoid areas identified as within a 100-year floodplain;
 - 41
42 • Before a new well is drilled within the Bill Williams basin, a Notice of Intent
43 to Drill must be filed with the ADWR, and any groundwater rights policy of
44 the ADWR must be followed (ADWR 2010c);
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- Groundwater monitoring and production wells should be constructed in accordance with state standards (ADWR 2010d);
- Stormwater management plans and best management practices should comply with standards developed by the Arizona Department of Environmental Quality (ADEQ 2010);
- Water for potable uses would have to meet or be treated to meet drinking water quality standards; and
- Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site and downstream in Bullard Wash.

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1 **8.2.10 Vegetation**
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3 This section addresses vegetation that could occur or is known to occur within the
4 potentially affected area of the proposed Bullard Wash SEZ. The affected area considered in this
5 assessment includes the areas of direct and indirect effects. The area of direct effects is defined
6 as the area that would be physically modified during project development (i.e., where ground-
7 disturbing activities would occur) and includes the SEZ, a 250-ft (76-m) wide portion of an
8 assumed transmission line corridor, and a 60-ft (18-m) wide portion of an assumed access road
9 corridor. The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ
10 boundary, within the 1-mi (1.6-km) wide assumed transmission line corridor, and within the 1-mi
11 (1.6-km) wide assumed access road corridor, where ground-disturbing activities would not occur
12 but that could be indirectly affected by activities in the area of direct effects.
13

14 Indirect effects considered in the assessment included effects from surface runoff, dust,
15 and accidental spills from the SEZ, but did not include ground-disturbing activities. The potential
16 degree of indirect effects would decrease with increasing distance from the SEZ. This area of
17 indirect effects was identified on the basis of professional judgment and was considered
18 sufficiently large to bound the area that would potentially be subject to indirect effects. The
19 affected area is the area bounded by the areas of direct and indirect effects. These areas are
20 defined and the impact assessment approach is described in Appendix M.
21

22
23 **8.2.10.1 Affected Environment**
24

25 The proposed Bullard Wash SEZ is located within the Sonoran Basin and Range Level III
26 ecoregion (EPA 2007), which supports creosotebush (*Larrea tridentata*)-white bursage
27 (*Ambrosia dumosa*) plant communities with large areas of palo verde (*Parkinsonia microphylla*)-
28 cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant
29 species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily
30 creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis*
31 *rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western
32 honey mesquite (*Prosopis glandulosa* var. *torreyana*) dominant in some areas (Turner and
33 Brown 1994). Larger drainageways and washes support species of small trees and shrubs that
34 may also occur in adjacent areas, such as western honey mesquite, ironwood (*Olneya tesota*),
35 and blue palo verde (*Parkinsonia florida*) as well as species such as smoketree (*Psorothamnus*
36 *spinus*), which are mostly restricted to drainageways. Shrub species found in minor drainages
37 include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola* var. *pentalepis*),
38 Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). The
39 proposed Bullard Wash SEZ is located in an area transitional to the Arizona Upland subdivision,
40 which includes Sonoran Paloverde-Mixed Cacti Desert Scrub communities, and Mojave desert
41 scrub, which includes Joshua tree (*Yucca brevifolia*)-creosotebush communities. Annual
42 precipitation in the Sonoran Desert occurs in winter and summer (Turner and Brown 1994)
43 and is low in the area of the SEZ, averaging about 8.5 in. (21.5 cm) at Aguila, Arizona
44 (see Section 8.2.13).
45

1 Land cover types, described and mapped under SWReGAP (USGS 2005a) were used to
2 evaluate plant communities in and near the SEZ. Each cover type encompasses a range of similar
3 plant communities. Land cover types occurring within the potentially affected area of the
4 proposed Bullard Wash SEZ are shown in Figure 8.2.10.1-1. Table 8.2.10.1-1 provides the
5 surface area of each cover type within the potentially affected area.
6

7 Lands within the proposed Bullard Wash SEZ are classified primarily as Sonora–Mojave
8 Creosotebush–White Bursage Desert Scrub. Additional cover types within the SEZ are given
9 in Table 8.2.10.1-1. During a September 2009 visit to the site, dominant species observed in
10 the desert scrub communities present within the SEZ included creosotebush, Joshua tree,
11 ocotillo (*Fouquieria splendens*), and saguaro cactus. Much of the SEZ supports a Joshua tree–
12 creosotebush community. Saguaro cactus and ocotillo are characteristic Sonoran Desert species,
13 while Joshua tree is a characteristic Mojave Desert species. Cacti species observed within the
14 SEZ were saguaro cactus, cholla (*Opuntia* spp.), and barrel cactus (*Ferocactus* sp.). Sensitive
15 habitats on the SEZ include desert dry washes, dry wash woodlands, and desert riparian mesquite
16 bosque, which is dependent on accessible groundwater. Cryptogammic soil crusts occur in some
17 areas of the SEZ. Much of the SEZ supports a high-quality, diverse, Sonoran-Mojave desert
18 scrub community. The area has a history of livestock grazing, and the plant communities on the
19 SEZ have likely been affected by grazing.
20

21 The area of indirect effects, including the area within 5 mi (8 km) around the SEZ, the
22 assumed access road corridor, and the assumed transmission line corridor, includes 12 cover
23 types, which are listed in Table 8.2.10.1-1. The predominant cover types are Sonora–Mojave
24 Creosotebush–White Bursage Desert Scrub and Sonoran Paloverde-Mixed Cacti Desert Scrub.
25

26 Three small wetlands mapped by the NWI occur in the Bullard Wash SEZ
27 (USFWS 2009) (Figure 8.2.10.1-2). NWI maps are produced from high-altitude imagery and
28 are subject to uncertainties inherent in image interpretation (USFWS 2009). These wetlands
29 occur along dry washes and are classified as intermittently flooded palustrine wetlands with
30 sparse plant communities (less than 30% vegetation cover). They range in size from 0.4 to
31 0.8 acres (0.002 to 0.003 km²) and total 1.7 acres (0.007 km²). One or more of these wetlands is
32 developed for a livestock watering area. Numerous ephemeral dry washes occur within the SEZ,
33 generally flowing to the southwest, to Bullard Wash. These dry washes typically contain water
34 for short periods during or following precipitation events and include temporarily flooded areas.
35 Although these washes generally do not support wetland or riparian habitats, woodlands occur
36 along the margins of a number of the larger washes. Several areas within the SEZ are mapped
37 as North American Warm Desert Riparian Mesquite Bosque. A total of 35 wetlands, ranging in
38 size from 0.1 to 3.0 acres (0.0004 to 0.01 km²), are mapped in the area of indirect effects within
39 5 mi (8 km) of the SEZ. These wetlands are classified primarily as intermittently flooded to
40 temporarily flooded palustrine wetlands with sparse plant communities. A number of these
41 wetlands occur near Bullard Wash, including two riverine wetlands, 2.0 and 3.0 acres (0.008 and
42 0.01 km²) in size, which occur within the channel. One 0.3-acre (0.001-km²) palustrine wetland
43 with a scrub-shrub plant community occurs southwest of Bullard Wash. A number of areas in the
44 area of indirect effects within 5 mi (8 km) of the SEZ are mapped as North American Warm
45 Desert Wash, North American Warm Desert Riparian Mesquite Bosque, and North American
46 Warm Desert Riparian Woodland and Shrubland. The assumed access road corridor and
47 transmission line corridor include areas mapped as North American Warm Desert Riparian

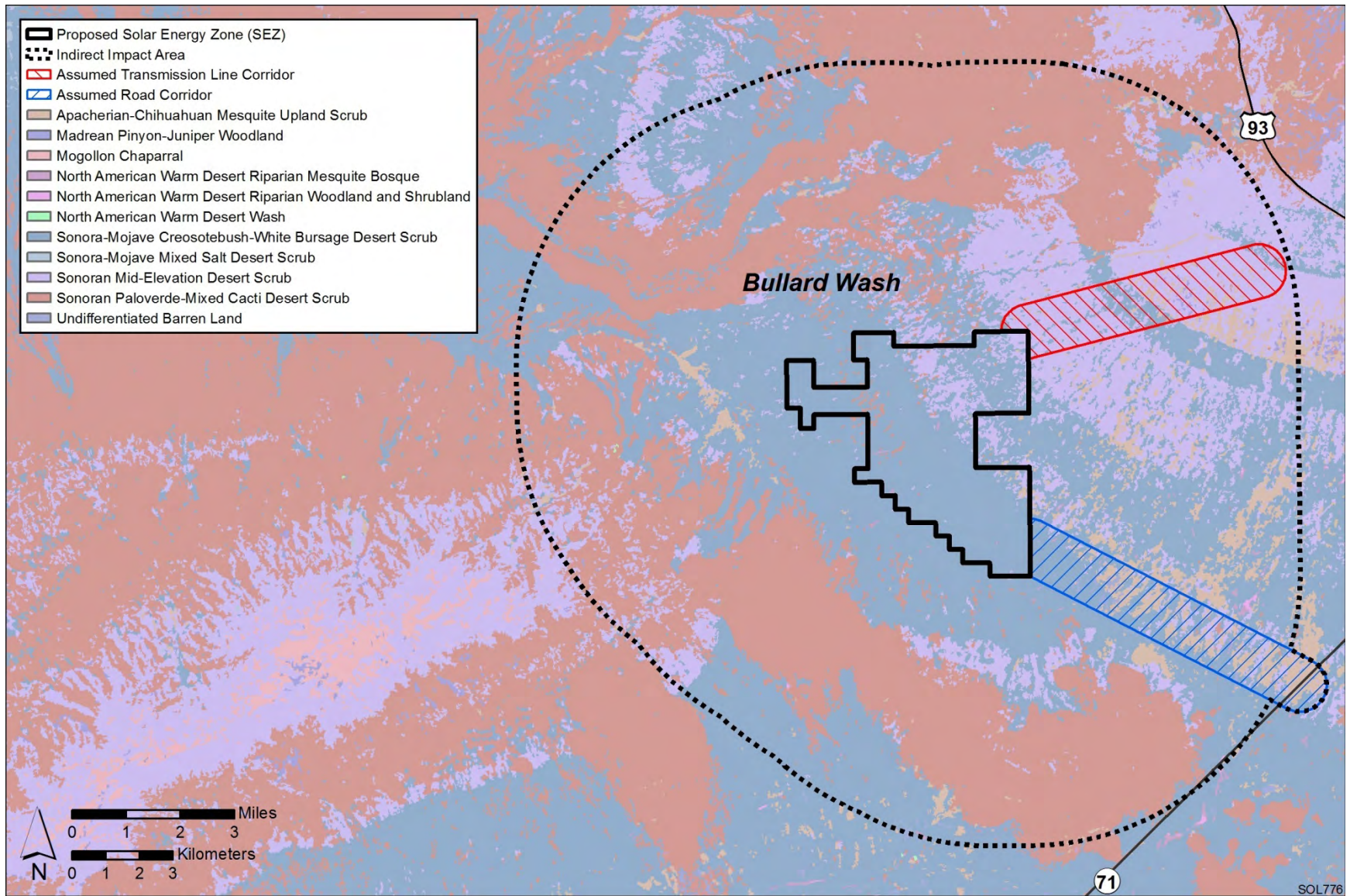


FIGURE 8.2.10.1-1 Land Cover Types within the Proposed Bullard Wash SEZ (Source: USGS 2004)

TABLE 8.2.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Bullard Wash SEZ and Potential Impacts

Land Cover Type ^a	Area of Cover Type Affected (acres) ^b				
	Within SEZ (Direct Effects) ^c	Assumed Access Road (Direct Effects) ^d	Assumed Transmission Line (Direct Effects) ^e	Corridors and Outside SEZ (Indirect Effects) ^f	Overall Impact Magnitude ^g
<p>Sonora-Mojave Creosotebush-White Bursage Desert Scrub: Occurs in broad valleys, lower bajadas, plains, and low hills in the Mojave and Sonoran deserts. Shrubs form a sparse to moderately dense cover (2 to 50%), although the ground surface may be mostly barren. The dominant species are typically creosotebush (<i>Larrea tridentata</i>) and white bursage (<i>Ambrosia dumosa</i>). Other shrubs, dwarf-shrubs, and cacti may also be dominant or form sparse understories. Herbaceous species are typically sparse, but may be seasonally abundant.</p>	6,147 acres ^h (0.6%, 1.3%)	21 acres (<0.1%)	24 acres (<0.1%)	40,401 acres (3.7%)	Small
<p>Sonoran Mid-Elevation Desert Scrub: Occurs on lower slopes along the northern edge of the Sonoran Desert. Generally consists of an open shrub layer and a generally sparse herbaceous layer.</p>	886 acres (0.4%, 0.7%)	4 acres (<0.1%)	118 acres (0.1%)	18,346 acres (8.1%),	Small
<p>Sonoran Paloverde-Mixed Cacti Desert Scrub: Occurs on hillsides, mesas, and upper bajadas. The tall shrubs yellow palo verde (<i>Parkinsonia microphylla</i>) and creosotebush (<i>Larrea tridentata</i>), which are sparse to moderately dense, and/or sparse saguaro cactus (<i>Carnegiea gigantea</i>) characterize the vegetation. Other shrubs and cacti are typically present. Perennial grasses and forbs are sparse. Annual species are seasonally present and may be abundant.</p>	135 acres (<0.1%, 0.1%)	<1 acre (<0.1%)	<1 acre (<0.1%)	38,717 acres (1.8%)	Small
<p>Apacherian-Chihuahuan Mesquite Upland Scrub: Occurs on foothills where deeper soil layers store winter precipitation. Dominant species are western honey mesquite (<i>Prosopis glandulosa</i>) or velvet mesquite (<i>P. velutina</i>) along with succulents and other deep-rooted shrubs. Cover of grasses is low.</p>	36 acres (<0.1%, 0.1%)	11 acres (<0.1%)	10 acres (<0.1%)	4,797 acres (1.6%)	Small

TABLE 8.2.10.1-1 (Cont.)

Land Cover Type ^a	Area of Cover Type Affected (acres) ^b				Overall Impact Magnitude ^g
	Within SEZ (Direct Effects) ^c	Assumed Access Road (Direct Effects) ^d	Assumed Transmission Line (Direct Effects) ^e	Corridors and Outside SEZ (Indirect Effects) ^f	
<p>North American Warm Desert Riparian Mesquite Bosque: Occurs along perennial and intermittent streams as relatively dense riparian corridors composed of trees and shrubs. Honey mesquite (<i>Prosopis glandulosa</i>) and velvet mesquite (<i>P. velutina</i>) are the dominant trees. Vegetation is supported by groundwater when surface water is absent.</p>	15 acres (0.3%, 1.5%)	<1 acre (<0.1%)	<1 acre (<0.1%)	110 acres (2.3%)	Small
<p>Barren lands nonspecific: Includes a variety of barren areas, generally with less than 15% cover of vegetation.</p>	8 acres (0.1%, <0.4%)	1 acre (<0.1%)	<1 acre (<0.1%)	161 acres (2.5%)	Small
<p>North American Warm Desert Riparian Woodland and Shrubland: Occurs along medium to large perennial streams in canyons and desert valleys. Consists of a mix of riparian woodlands and shrublands. Vegetation is dependent upon annual or periodic flooding, along with substrate scouring, and/or a seasonally shallow water table.</p>	0 acres	<1 acre (<0.1%)	0 acres	31 acres (0.5%)	Small
<p>Madrean Pinyon-Juniper Woodland: Occurs on foothills, mountains, and plateaus. Mexican pinyon (<i>Pinus cembroides</i>), border pinyon (<i>P. discolor</i>), or other trees and shrubs of the Sierra Madres are present. Dominant species may include redberry juniper (<i>Juniperus coahuilensis</i>), alligator juniper (<i>J. deppeana</i>), Pinchot's juniper (<i>J. pinchotii</i>), oneseed juniper (<i>J. monosperma</i>), or twoneedle pinyon (<i>P. edulis</i>). Oaks (<i>Quercus</i> sp.) may be codominant. Understory shrub or graminoid layers may be present.</p>	0 acres	0 acres	2 acres (<0.1%)	123 acres (<0.1%)	Small

TABLE 8.2.10.1-1 (Cont.)

Land Cover Type ^a	Area of Cover Type Affected (acres) ^b				Overall Impact Magnitude ^g
	Within SEZ (Direct Effects) ^c	Assumed Access Road (Direct Effects) ^d	Assumed Transmission Line (Direct Effects) ^e	Corridors and Outside SEZ (Indirect Effects) ^f	
North American Warm Desert Wash: Consists of intermittently flooded linear or braided strips within desert scrub or grassland landscapes on bajadas, mesas, plains, and basin floors. Although often dry, washes are associated with rapid sheet and gully flow. The vegetation varies from sparse and patchy to moderately dense and typically occurs along the banks, but may occur within the channel. Shrubs and small trees are typically intermittent to open. Common upland shrubs often occur along the edges.	0 acres	0 acres	0 acres	4 acres (0.1%)	Small
Sonora-Mojave Mixed Salt Desert Scrub: Extensive open-canopied shrublands in the Mojave and Sonoran Deserts, usually occurring around playas and in valley bottoms or basins with saline soils. Vegetation is typically composed of one or more <i>Atriplex</i> species; other salt-tolerant plants are often present or even codominant. Grasses occur at varying densities.	0 acres	0 acres	0 acres	1 acre (<0.1%)	Small

^a Land cover descriptions are from USGS (2005a). Full descriptions of land cover types, including plant species, can be found in Appendix I.

^b Area in acres, determined from USGS (2004).

^c Includes the area of the cover type within the SEZ, the percentage that area represents of all occurrences of that cover type within the SEZ region (i.e., a 50-mi [80-km] radius from the center of the SEZ), and the percentage that area represents of all occurrences of that cover type on BLM lands within the SEZ region.

^d For access road development, direct effects were estimated within a 5-mi (8-km) long, 60-ft (18-m) wide road ROW from the SEZ to the nearest state highway. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide road corridor. Impacts are for the area of the cover type within the assumed ROW, and the percentage that area represents of all occurrences of that cover type within the SEZ region.

Footnotes continued on next page.

TABLE 8.2.10.1-1 (Cont.)

- ^e For transmission development, direct effects were estimated within a 5-mi (8-km) long, 250-ft (76-m) wide transmission ROW from the SEZ to the nearest existing line. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide transmission corridor. Impacts are for the area of the cover type within the assumed ROW, and the percentage that area represents of all occurrences of that cover type within the SEZ region.
- ^f Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portions of the 1-mi (1.6-km) wide road and transmission corridors where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project facilities. The potential degree of indirect effects would decrease with increasing distance from the SEZ. Includes the area of the cover type within the indirect effects area and the percentage that area represents of all occurrences of that cover type within the SEZ region.
- ^g Overall impact magnitude categories were based on professional judgment and are (1) *small*: a relatively small proportion of the cover type ($\leq 1\%$) within the SEZ region would be lost; (2) *moderate*: an intermediate proportion of a cover type (>1 but $\leq 10\%$) would be lost; and (3) *large*: $>10\%$ of a cover type would be lost.
- ^h To convert acres to km^2 , multiply by 0.004047.

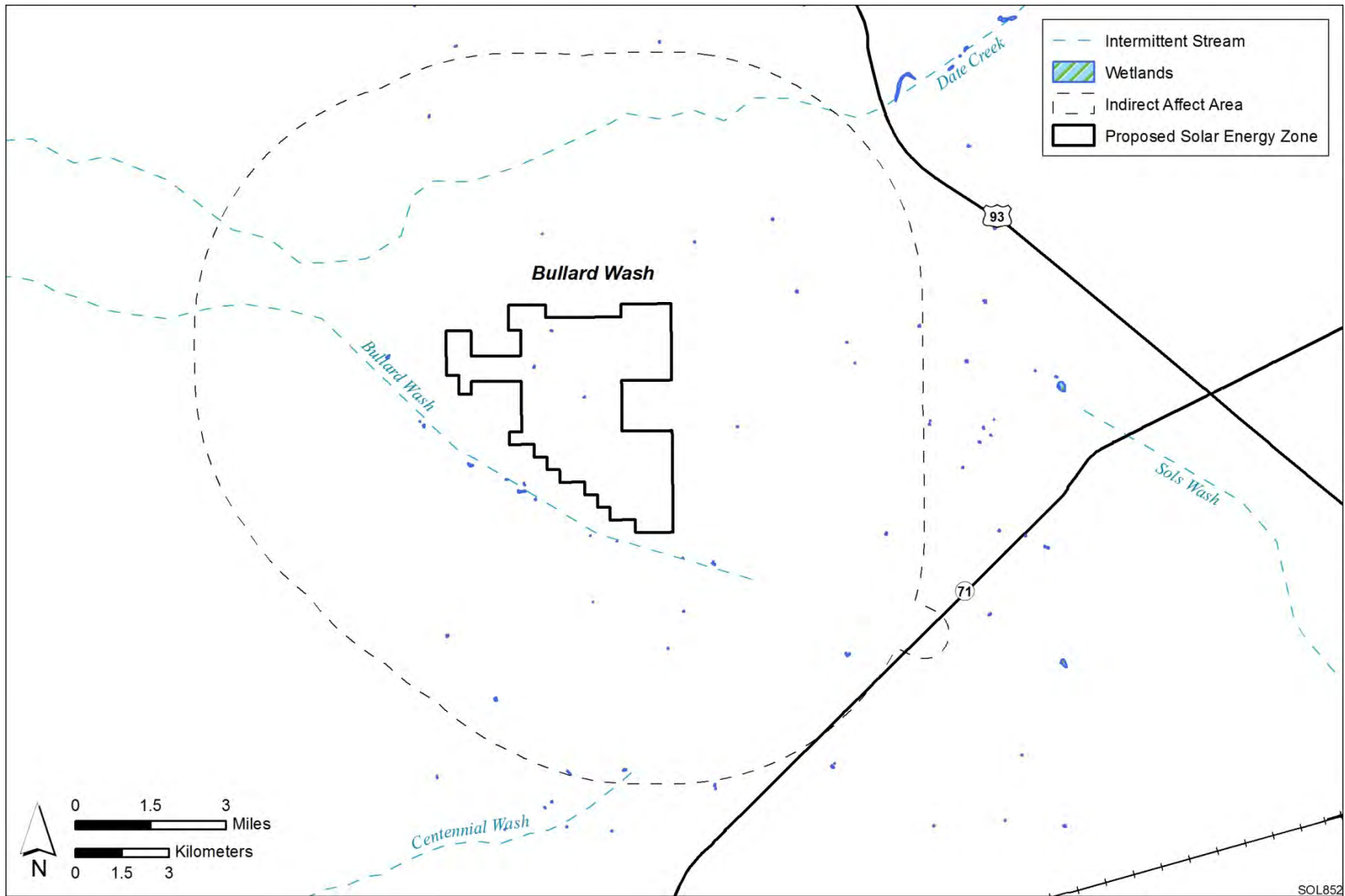


FIGURE 8.2.10.1-2 Wetlands within the Proposed Bullard Wash SEZ (Source: USFWS 2009)

Mesquite Bosque, and North American Warm Desert Riparian Woodland and Shrubland occurs in the road corridor. Tres Alamos Spring, northwest of the SEZ, and Yerba Mansa Spring, north of the SEZ, support riparian habitat. Riparian habitats along the Santa Maria River may also be supported by groundwater discharge.

The State of Arizona maintains an official list of weed species that are designated noxious species (AZDA 2010). Table 8.2.10.1-2 provides a summary of the noxious weed species regulated in Arizona that are known to occur in Yavapai County (USDA 2010b), which includes the proposed Bullard Wash SEZ. No species included in Table 8.2.10.1-2 were observed on the SEZ during a site visit in September 2009.

The Arizona Department of Agriculture classifies noxious weeds into one of three categories (AZDA 2010):

- “Prohibited: Noxious weeds (includes plants, stolons, rhizomes, cuttings, and seed) that are prohibited from entry into the state.”
- “Regulated: Noxious weeds that are regulated (includes plants, stolons, rhizomes, cuttings, and seed) and if found within the state may be controlled or quarantined to prevent further infestation or contamination.”
- “Restricted: Noxious weeds that are restricted (includes plants, stolons, rhizomes, cuttings, and seed) and if found within the state shall be quarantined to prevent further infestation or contamination.”

TABLE 8.2.10.1-2 Designated Noxious Weeds of Arizona Occurring in Yavapai County

Common Name	Scientific Name	Category
Burclover	<i>Medicago polymorpha</i>	Regulated, prohibited
Canada thistle	<i>Cirsium arvense</i>	Prohibited
Common purslane	<i>Portulaca oleracea</i>	Regulated, prohibited
Dalmatian toadflax	<i>Linaria genistifolia</i> ssp. <i>dalmatica</i>	Restricted, prohibited
Dodder	<i>Cuscuta</i> spp.	Restricted, prohibited
Field bindweed	<i>Convolvulus arvensis</i>	Regulated, prohibited
Field sandbur	<i>Cenchrus incertus</i>	Regulated, prohibited
Jointed goatgrass	<i>Aegilops cylindrica</i>	Restricted, prohibited
Morning glory	<i>Ipomoea</i> spp.	Prohibited
Puncture vine	<i>Tribulus terrestris</i>	Regulated, prohibited
Russian knapweed	<i>Acroptilon repens</i>	Restricted, prohibited
Scotch thistle	<i>Onopordum acanthium</i>	Restricted, prohibited
Sweet resinbush	<i>Euryops subcarnosus</i> ssp. <i>vulgaris</i>	Restricted
Whitetop	<i>Cardaria draba</i>	Restricted, prohibited

Sources: AZDA (2010); USDA (2010b).

Table 8.2.10.1-3 presents a listing of invasive plant species that are known to occur in the BLM Bradshaw-Harquahala Planning Area (BLM 2010d), which includes the proposed Bullard Wash SEZ. No species listed in Table 8.2.10.1-3 was observed on the SEZ in August 2009.

8.2.10.2 Impacts

The construction of solar energy facilities within the proposed Bullard Wash SEZ would result in direct impacts on plant communities because of the removal of vegetation within the facility footprint during land-clearing and land-grading operations. Approximately 80% of the SEZ (5,791 acres [23.4 km²]) would be expected to be cleared with full development of the SEZ. The plant communities affected would depend on facility locations and could include any of the communities occurring on the SEZ. Therefore, for this analysis, all the area of each cover type within the SEZ is considered to be directly affected by removal with full development of the SEZ.

Indirect effects (caused, e.g., by surface runoff or dust from the SEZ) have the potential to degrade affected plant communities and may reduce biodiversity by promoting the decline or elimination of species sensitive to disturbance. Indirect effects can also cause an increase in disturbance-tolerant species or invasive species. High impact levels could result in the elimination of a community or the replacement of one community type by another. The proper implementation of programmatic design features, however, would reduce indirect effects to a minor or small level of impact.

Possible impacts from solar energy facilities on vegetation encountered within the SEZ, as well as general mitigation measures, are described in more detail in Section 5.10.4. Any such impacts would be minimized through implementation of required programmatic design features described in Appendix A, Section A.2.2 (selected from the general mitigation measures) and application of any additional mitigation measures.

TABLE 8.2.10.1-3 Invasive Plant Species Occurring in the Bradshaw-Harquahala Planning Area

Common Name	Scientific Name
African mustard	<i>Brassica tournefortii</i>
Fountain grass	<i>Pennisetum alopecuroides</i>
Bufflegrass	<i>Cenchrus ciliaris</i>
Wild oats	<i>Avena fatua</i>
Saltcedar	<i>Tamarix ramosissima</i>

Sources: BLM (2010d).

8.2.10.2.1 Impacts on Native Species

The impacts of construction, operation, and decommissioning were considered small if the impact affected a relatively small proportion (<1%) of the cover type in the SEZ region (within 50 mi [80 km] of the center of the SEZ); moderate (>1 but <10%) if the impact could affect an intermediate proportion of cover type; and large if the impact could affect more than 10% of a cover type.

Solar facility construction and operation in the proposed Bullard Wash SEZ would primarily affect communities of the Sonora–Mojave Creosotebush–White Bursage Desert Scrub cover type. Additional cover types that would be affected within the SEZ include Sonoran Mid-Elevation Desert Scrub, Sonoran Paloverde–Mixed Cacti Desert Scrub, Apacherian–Chihuahuan Mesquite Upland Scrub, North American Warm Desert Riparian Mesquite Bosque, and Barren Lands Non-specific. Table 8.2.10.1-1 summarizes the potential impacts on land cover types resulting from solar energy facilities in the proposed Bullard Wash SEZ. Most of these cover types are relatively common in the SEZ region; however, several are relatively uncommon, representing 1% or less of the land area within the SEZ region: North American Warm Desert Riparian Mesquite Bosque (0.09%), Barren Lands Non-specific (0.1%). In addition, North American Warm Desert Riparian Woodland and Shrubland (0.1%) would potentially be affected by the access road ROW. Desert dry wash, dry wash woodlands, and mesquite bosque are important sensitive habitats in the region.

The construction, operation, and decommissioning of solar projects within the proposed Bullard Wash SEZ would result in small impacts on all cover types in the affected area.

Because of the arid conditions, reestablishment of desert scrub communities in temporarily disturbed areas would likely be very difficult and might require extended periods of time. In addition, noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation. Cryptogamic soil crusts occur in many of the shrubland communities in the region and likely occur on the SEZ. Damage to these crusts, by the operation of heavy equipment or other vehicles, can alter important soil characteristics, such as nutrient cycling and availability, and affect plant community characteristics (Lovich and Bainbridge 1999).

The deposition of fugitive dust from large areas of disturbed soil onto habitats outside a solar energy project site could result in reduced productivity or changes in plant community composition. Fugitive dust deposition could affect plant communities of each of the cover types occurring within the area of indirect effects identified in Table 8.2.10.1-1.

The construction of access roads or transmission lines could result in impacts on woodland communities. Small areas of North American Warm Desert Riparian Woodland and Shrubland occur within the access road corridor, and small areas of Madrean Pinyon-Juniper Woodland occur in the transmission line corridor. Woodland habitat within the ROWs would likely be converted to shrub- or grass-dominated habitat. Clearing of woodland along the ROWs during construction would contribute to fragmentation of these habitats and changes in

characteristics in adjacent areas, such as light and soil moisture conditions. As a result, woodland communities along the ROWs could be degraded. ROW management would maintain altered habitat conditions within and adjacent to the ROWs.

Approximately 1.7 acres (0.007 km²) of wetlands occurs within the SEZ. Grading could result in direct impacts on these wetlands if fill material is placed there. Grading near the wetlands in the SEZ could disrupt surface water or groundwater flow characteristics, resulting in changes in the frequency, duration, depth, or extent of inundation or soil saturation, and could potentially alter wetland plant communities and affect wetland function. Increases in surface runoff from a solar energy project site could also affect wetland hydrologic characteristics. The introduction of contaminants into wetlands in or near the SEZ could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in wetland areas, which could degrade or eliminate wetland plant communities. Sedimentation effects or hydrologic changes could also extend to wetlands outside the SEZ, such as those in or near Bullard Wash.

Grading could also affect dry washes within the SEZ, assumed access road corridor, and assumed transmission line corridor. Desert dry washes in the SEZ and corridors support woodland communities. Alteration of surface drainage patterns or hydrology could adversely affect downstream dry wash communities. Vegetation within these communities could be lost by erosion or desiccation. Communities associated with intermittently flooded areas downgradient from solar projects in the SEZ could be affected by ground-disturbing activities. Site clearing and grading could result in hydrologic changes and could potentially alter plant communities and affect community function. Increases in surface runoff from a solar energy project site could also affect hydrologic characteristics of these communities. The introduction of contaminants into these habitats could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in these areas, which could degrade or eliminate sensitive plant communities. Direct impacts on wetlands and desert washes that are waters of the United States would require permitting from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. See Section 8.2.9 for further discussion of impacts on washes.

The construction of access roads or transmission lines in ROWs outside of the SEZ could potentially result in direct impacts on riparian habitat that occurs in or near the ROWs. Small areas of North American Warm Desert Riparian Woodland and Shrubland occur within the assumed access road corridor, and small areas of North American Warm Desert Riparian Mesquite Bosque occur within the assumed access road and transmission line corridors. These riparian habitats could also be indirectly affected by access road or transmission line construction or operation.

Although the use of groundwater within the Bullard Wash SEZ by technologies with high water requirements, such as wet-cooling systems, may be unlikely, groundwater withdrawals for such systems could reduce groundwater elevations. Communities in the vicinity of the SEZ that depend on accessible groundwater, such as mesquite bosque communities or communities associated with springs, such as Tres Alamos Spring or Yerba Mansa Spring, could become

degraded or lost as a result of lowered groundwater levels. Riparian habitats along the Santa Maria River also may be affected.

8.2.10.2 Impacts from Noxious Weeds and Invasive Plant Species

On February 8, 1999, the President signed E.O. 13112, “Invasive Species,” which directs federal agencies to prevent the introduction of invasive species, provide for their control, and minimize their economic, ecological, and human health impacts (*Federal Register*, Volume 64, page 6183, Feb. 8, 1999). Potential impacts of noxious weeds and invasive plant species resulting from solar energy facilities are described in Section 5.10.1. Despite required programmatic design features to prevent the spread of noxious weeds, project disturbance could potentially increase the prevalence of noxious weeds and invasive species in the affected area of the proposed Bullard Wash SEZ, such that weeds could be transported into areas that were previously relatively weed-free, and this could result in reduced restoration success and possible widespread habitat degradation.

Species designated as noxious weeds in Arizona and known to occur in Yavapai County are given in Table 8.2.10.1-2; species designated as invasive species, and known to occur in the Bradshaw-Harquahala Planning Area, are listed in Table 8.2.10.1-3. Past or present land uses may affect the susceptibility of plant communities to the establishment of noxious weeds and invasive species. Existing roads, grazing, and recreational OHV use within the SEZ area of potential impact also likely contribute to the susceptibility of plant communities to the establishment and spread of noxious weeds and invasive species.

8.2.10.3 SEZ-Specific Design Features and Design Feature Effectiveness

In addition to programmatic design features, SEZ-specific design features would reduce the potential for impacts on plant communities. While specific practices are best established when project details are considered, some measures can be identified at this time, as follows.

- An Integrated Vegetation Management Plan, addressing invasive species control, and an Ecological Resources Mitigation and Monitoring Plan, addressing habitat restoration, should be approved and implemented to increase the potential for successful restoration of creosotebush-white bursage desert scrub communities and other affected habitats and to minimize the potential for the spread of noxious weeds or invasive species, such as those occurring in Yavapai County or the Bradshaw-Harquahala Planning Area, that could be introduced as a result of solar energy project activities (see Section 8.2.10.2.2). Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.
- All wetland, dry wash, woodland, mesquite bosque, riparian, Joshua tree, and saguaro cactus communities within the SEZ or corridors should be avoided to the extent practicable and any impacts minimized and mitigated. Any Joshua

trees or cacti that cannot be avoided should be salvaged. A buffer area should be maintained around wetland, dry washes, dry wash woodland, mesquite bosque habitats, and riparian habitats to reduce the potential for impacts. Transmission line towers should be sited and constructed to minimize impacts on these habitats and to span them whenever practicable.

- Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, dry wash woodland, mesquite bosque, and riparian habitats, including downstream occurrences resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition. Appropriate buffers and engineering controls would be determined through agency consultation.
- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities, or riparian communities associated with springs, such as Yerba Mansa Spring or Tres Alamos Spring, or along the Santa Maria River.

If these SEZ-specific design features are implemented in addition to programmatic design features, it is anticipated that a high potential for impacts from invasive species and potential impacts on wetland, dry wash, dry wash woodland, mesquite bosque, riparian habitats, Joshua tree, and saguaro cactus communities would be reduced to a minimal potential for impacts.

8.2.11 Wildlife and Aquatic Biota

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could occur within the potentially affected area of the proposed Bullard Wash SEZ. Wildlife known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from Arizona Field Ornithologists (2010), Brennan (2008), Hoffmeister (1986), and SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007). The amount of aquatic habitat within the SEZ region was determined by estimating the length of linear perennial stream features and the area of standing water body features (i.e., ponds, lakes, and reservoirs) within 50 mi (80 km) of the SEZ using available GIS surface water datasets.

The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and included the SEZ, a 250-ft (76-m) wide portion of an assumed 5-mi (8-km) long transmission line corridor and a 60-ft (18-m) wide portion of an assumed 5-mi (8-km) long access road. The maximum developed area within the SEZ would be 5,791 acres (23.4 km²) and the maximum developed area within the transmission line and access road would be 151 acres (0.6 km²) and 36 acres (0.15 km²), respectively.

The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1.0-mi (1.6-km) wide assumed transmission line and access road corridors where ground-disturbing activities would not occur, but that could be indirectly affected by activities in the area of direct effect (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or transmission line and access road construction areas). Potentially suitable habitat for a species within the SEZ greater than the maximum of 5,791 acres (23.4 km²) of direct effect was also included as part of the area of indirect effects. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. The area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. These areas of direct and indirect effect are defined and the impact assessment approach is described in Appendix M.

The primary land cover habitat types within the affected area are Sonora–Mojave creosotebush–white bursage desert scrub, Sonoran Paloverde–Mixed Cacti Desert Scrub, and Sonoran mid-elevation desert scrub (see Section 8.2.10). Bullard Wash, an intermittent streambed that exists along the southwestern boundary of the SEZ within the area of indirect impacts, is the only potential aquatic habitat within the affected area. Several isolated wetlands within the SEZ and area of indirect impacts could also contain standing water on an intermittent basis. Other washes, Bill Williams River, and Alamo Lake occur within the SEZ region (Figure 8.2.9.1-1).

1 **8.2.11.1 Amphibians and Reptiles**

2
3
4 **8.2.11.1.1 Affected Environment**

5
6 This section addresses amphibian and reptile species that are known to occur, or for
7 which potentially suitable habitat occurs, on or within the potentially affected area of the
8 proposed Bullard Wash SEZ. The list of amphibian and reptile species potentially present in the
9 SEZ area was determined from species lists available from Brennan (2008) and range maps and
10 habitat information available from the SWReGAP (USGS 2007). Land cover types suitable for
11 each species were determined from SWReGAP (USGS 2004, 2005a, 2007). See Appendix M for
12 additional information on the approach used.

13
14 Based on species distributions within the area of the SEZ and habitat preferences of
15 the amphibian species, the Great Basin spadefoot (*Spea intermontana*) and red-spotted toad
16 (*Bufo punctatus*) would be expected to occur within the SEZ (Brennan 2008; USGS 2007;
17 Stebbins 2003). These species could breed within the isolated wetlands when standing water
18 is available.

19
20 More than 30 reptile species occur within the area that encompasses the proposed Bullard
21 Wash SEZ (Brennan 2008; USGS 2007; Stebbins 2003). The desert tortoise (*Gopherus agassizii*)
22 is a federal and state listed threatened species and is discussed in Section 8.2.12. Lizard species
23 expected to occur within the SEZ include the desert horned lizard (*Phrynosoma platyrhinos*),
24 Great Basin collared lizard (*Crotaphytus bicinctores*), side-blotched lizard (*Uta stansburiana*),
25 western whiptail (*Cnemidophorus tigris*), and zebra-tailed lizard (*Callisaurus draconoides*).
26

27 Snake species expected to occur within the SEZ include the coachwhip (*Masticophis*
28 *flagellum*), common kingsnake (*Lampropeltis gentula*), glossy snake (*Arizona elegans*),
29 gophersnake (*Pituophis catenifer*), groundsnake (*Sonora semiannulata*), and nightsnake
30 (*Hypsiglena torquata*). The Mohave rattlesnake (*Crotalus scutulatus*), sidewinder (*C. cerastes*),
31 and western diamond-backed rattlesnake (*C. atrox*) would be the most common poisonous snake
32 species expected to occur on the SEZ.

33
34 Table 8.2.11.1-1 provides habitat information for representative amphibian and reptile
35 species that could occur within the proposed Bullard Wash SEZ.

36
37
38 **8.2.11.1.2 Impacts**

39
40 The types of impacts that amphibians and reptiles could incur from construction,
41 operation, and decommissioning of utility-scale solar energy facilities are discussed in
42 Section 5.10.2.1. Any such impacts would be minimized through the implementation of
43 required programmatic design features described in Appendix A, Section A.2.2, and
44 application of additional mitigation applied. Section 8.2.11.1.3, below, identifies SEZ-
45 specific design features of particular relevance to the proposed Bullard Wash SEZ.
46

TABLE 8.2.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur on or in the Affected Area of the Proposed Bullard Wash SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Amphibians						
Great Basin spadefoot (<i>Spea intermontana</i>)	Sagebrush flats, semidesert shrublands, pinyon-juniper woodlands, and spruce-fir forests. Breeds in temporary and permanent waters including rain pools, pools in intermittent streams, and flooded areas along streams. About 1,162,900 acres ¹ of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	38,299 acres of potentially suitable habitat (3.3% of available potentially suitable habitat)	23 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 469 acres in area of indirect effect	24 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 2,113 acres in area of indirect effect	Small overall impact. Avoid wetland habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Red-spotted toad (<i>Bufo punctatus</i>)	Dry, rocky areas at lower elevations near desert springs and persistent pools along rocky arroyos, desert streams and oases, open grassland, scrubland oaks, and dry woodlands. About 4,177,800 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,323 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,043 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,434 acres in area of indirect effect	Small overall impact. Avoid wetland habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Lizards						
Desert horned lizard (<i>Phrynosoma platyrhinos</i>)	Deserts dominated by sagebrush, creosotebush, greasewood, or cactus. Occurs on sandy flats, alluvial fans, washes, and edges of dunes. Burrows in soil during periods of inactivity. About 3,538,400 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	92,903 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	140 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 2,821 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,244 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Great Basin collared lizard (<i>Crotaphytus bicinctores</i>)	Usually inhabits alluvia, lava flows, mountain slopes, canyons, buttes, rock outcrops, washes, and rocky plains. Limiting factors are the presence of large boulders and open/sparse vegetation. About 3,524,100 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	92,773 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	140 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 2,820 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,245 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Lizards (Cont.)						
Side-blotched lizard (<i>Uta stansburiana</i>)	Low to moderate elevations in washes, arroyos, boulder-strewn ravines, rocky cliff bases, and flat shrubby areas in canyon bottoms. Often along sandy washes. Usually in areas with a lot of bare ground. About 4,035,000 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,733 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 698 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,136 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Western whiptail (<i>Cnemidophorus tigris</i>)	Arid and semiarid habitats with sparse plant cover. About 4,690,600 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,456 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Lizards (Cont.)						
Zebra-tailed lizard (<i>Callisaurus draconoides</i>)	Open, warm-desert habitats, especially dry washes and canyons with fine gravel and sand. About 3,605,600 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	80,775 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 665 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,161 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Snakes						
Coachwhip (<i>Masticophis flagellum</i>)	Creosotebush desert, shortgrass prairie, shrub-covered flats and hills. Sandy to rocky substrates. Avoids dense vegetation. About 4,009,200 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,729 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 698 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,136 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Snakes (Cont.)						
Common kingsnake (<i>Lampropeltis getula</i>)	Coniferous forests, woodlands, swampland, coastal marshes, river bottoms, farmlands, prairies, chaparral, and deserts. Uses rock outcrops and rodent burrows for cover. About 4,967,600 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Glossy snake (<i>Arizona elegans</i>)	Light shrubby to barren deserts, sagebrush flats, grasslands, and chaparral-covered slopes and woodlands. Prefers sandy grasslands, shrublands and woodlands. About 3,601,400 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	80,750 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 665 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,154 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^d	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Snakes (Cont.)						
Gophersnake (<i>Pituophis catenifer</i>)	Plains grasslands, sand hills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 4,927,100 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Groundsnake (<i>Sonora semiannulata</i>)	Arid and semiarid regions with rocky to sandy soils. River bottoms, desert flats, sand hummocks, and rocky hillsides. About 4,273,300 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,452 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Snakes (Cont.)						
Mohave rattlesnake (<i>Crotalus scutulatus</i>)	Upland desert and lower mountain slopes including barren desert, grassland, open juniper woodland, and scrubland. Especially common in areas of scattered scrubby growth such as creosote and mesquite. About 5,017,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,592 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,493 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Nightsnake (<i>Hypsiglena torquata</i>)	Arid and semiarid desert flats, plains, and woodlands; areas with rocky and sandy soils are preferred. During cold periods of the year, it seeks refuge underground, in crevices, or under rocks. About 4,535,800 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,729 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 698 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,136 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Snakes (Cont.)						
Sidewinder (<i>Crotalus cerastes</i>)	Windblown sand habitats near rodent burrows. Most common in areas of sand hummocks topped with creosote, mesquite, or other desert plants. About 3,294,800 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	76,199 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	24 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 475 acres in area of indirect effect	34 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 2,954 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Western diamond-backed rattlesnake (<i>Crotalus atrox</i>)	Dry and semi-dry lowland areas. Usually found in brush-covered plains, dry washes, rock outcrops, and desert foothills. About 4,853,600 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

Footnotes on next page.

TABLE 8.2.11.1-1 (Cont.)

-
- ^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- ^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 5,791 acres of direct effect within the SEZ was assumed.
- ^c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- ^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 5,791 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.
- ^e For transmission line development, direct effects were estimated within a 5-mi (8-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.
- ^f For access road development, direct effects were estimated within a 5-mi (8-km) long, 60-ft (18-m) access road ROW from the SEZ to the nearest existing state route, U.S. highway, or interstate. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor to the existing road, less the assumed area of direct effects.
- ^g Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^h Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ⁱ To convert acres to km^2 , multiply by 0.004047.

Sources: Brennan (2008); CDFG (2008); NatureServe (2010); USGS (2004, 2005a, 2007).

1 The assessment of impacts on amphibian and reptile species is based on available
2 information on the presence of species in the affected area as presented in Section 8.2.11.1.1
3 following the analysis approach described in Appendix M. Additional NEPA assessments and
4 coordination with state natural resource agencies may be needed to address project-specific
5 impacts more thoroughly. These assessments and consultations could result in additional
6 required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 8.2.11.1.3).

7
8 In general, impacts on amphibians and reptiles would result from habitat disturbance
9 (i.e., habitat reduction, fragmentation, and alteration) and from disturbance, injury, or mortality
10 to individual amphibians and reptiles. On the basis of the magnitude of impacts on amphibians
11 and reptiles summarized in Table 8.2.11.1-1, direct impacts on representative amphibian and
12 reptile species would be small, ranging from a high of 0.5% for the Great Basin spadefoot to
13 0.1 to 0.2% for all other species (Table 8.2.11.1-1). Larger areas of potentially suitable habitats
14 for the amphibian and reptile species occur within the area of potential indirect effects (e.g., up
15 to 3.3% of available habitat for the Great Basin spadefoot and 1.8 to 2.6% for all other species).
16 Indirect impacts on amphibians and reptiles could result from surface water and sediment runoff
17 from disturbed areas, fugitive dust generated by project activities, accidental spills, collection,
18 and harassment. These indirect impacts are expected to be negligible with implementation of
19 programmatic design features.

20
21 Decommissioning after operations cease could result in short-term negative impacts on
22 individuals and habitats within and adjacent to the SEZ. The negative impacts of
23 decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term
24 benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4
25 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of
26 particular importance for amphibian and reptile species would be the restoration of original
27 ground surface contours, soils, and native plant communities associated with desert scrub and
28 wash habitats.

31 ***8.2.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness***

32
33 The implementation of required programmatic design features described in Appendix A,
34 Section A.2.2, would reduce the potential for effects on amphibians and reptiles, especially for
35 those species that utilize habitat types that can be avoided (e.g., washes). Indirect impacts could
36 be reduced to negligible levels by implementing programmatic design features, especially those
37 engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While
38 SEZ-specific design features are best established when project details are being considered, there
39 is one design feature that can be identified at this time:

- 40
41 • Isolated wetlands should be avoided.

42
43 If this SEZ-specific design feature is implemented in addition to other programmatic
44 design features, impacts on amphibian and reptile species could be reduced. However, as
45 potentially suitable habitats for the representative amphibian and reptile species occur throughout
46 much of the SEZ, additional species-specific mitigation of direct effects for those species would
47 be difficult or infeasible.

1 **8.2.11.2 Birds**

2
3
4 **8.2.11.2.1 Affected Environment**

5
6 This section addresses bird species that
7 are known to occur, or for which potentially
8 suitable habitat occurs, on or within the
9 potentially affected area of the proposed
10 Bullard Wash SEZ. The list of bird species
11 potentially present in the SEZ area was
12 determined from the Arizona Field
13 Ornithologists (2010) and range maps and
14 habitat information available from SWReGAP (USGS 2007). Land cover types suitable for each
15 species were determined from SWReGAP (USGS 2004, 2005a, 2007). See Appendix M for
16 additional information on the approach used.

Desert Focal Bird Species

Bird species whose requirements define spatial attributes, habitat characteristics, and management regimes representative of a healthy desert system (Chase and Geupel 2005).

17
18 Fourteen of the bird species that could occur on or in the affected area of the SEZ are
19 considered focal species in the *Desert Bird Conservation Plan* (CalPIF 2009): ash-throated
20 flycatcher (*Myiarchus cinerascens*), black-tailed gnatcatcher (*Polioptila melanura*), black-
21 throated sparrow (*Amphispiza bilineata*), burrowing owl (*Athene cunicularia*), common raven
22 (*Corvus corax*), Costa’s hummingbird (*Calypte costae*), crissal thrasher (*Toxostoma crissale*),
23 Gila woodpecker (*Melanerpes uropygialis*), ladder-backed woodpecker (*Picoides scalaris*),
24 Le Conte’s thrasher (*Toxostoma lecontei*), Lucy’s warbler (*Vermivora luciae*), phainopepla
25 (*Phainopepla nitens*), Scott’s oriole (*Icterus parisorum*), and verdin (*Auriparus flaviceps*).
26 Habitats for most of these species are described in Table 8.2.11.2-1. Due to its special species
27 status, the burrowing owl is discussed in Section 8.2.12.1.

28
29
30 **Waterfowl, Wading Birds, and Shorebirds**

31
32 As discussed in Section 4.10.2.2.2, waterfowl (ducks, geese, and swans), wading birds
33 (herons and cranes), and shorebirds (avocets, gulls, plovers, rails, sandpipers, stilts, and terns)
34 are among the most abundant groups of birds in the six-state solar study area. However, within
35 the proposed Bullard Wash SEZ, waterfowl, wading birds, and shorebird species would be
36 mostly absent to uncommon. Bullard Wash, within the area of indirect effects, and the isolated
37 wetlands within the affected area may occasionally attract shorebird species such as the killdeer
38 (*Charadrius vociferus*) and least sandpiper (*Calidris minutilla*). The Bill Williams River and
39 Alamo Lake, which occur within the 50-mi (80-km) SEZ region would provide more viable
40 habitat for this group of birds.

1 Neotropical Migrants

2
3 As discussed in Section 4.10.2.2.3, neotropical migrants represent the most diverse
4 category of birds within the six-state solar energy study area. Species expected to occur within
5 the proposed Bullard Wash SEZ include the ash-throated flycatcher, black-tailed gnatcatcher,
6 black-throated sparrow, Brewer's sparrow (*Spizella breweri*), cactus wren (*Campylorhynchus*
7 *brunneicapillus*), common poorwill (*Phalaenoptilus nuttallii*), common raven, Costa's
8 hummingbird, crissal thrasher, Gila woodpecker, greater roadrunner (*Geococcyx californianus*),
9 horned lark (*Eremophila alpestris*), ladder-backed woodpecker, Le Conte's thrasher, lesser
10 nighthawk (*Chordeiles acutipennis*), loggerhead shrike (*Lanius ludovicianus*), Lucy's warbler,
11 phainopepla, Say's phoebe (*Sayornis saya*), Scott's oriole, and verdin (Arizona Field
12 Ornithologists 2010; CalPIF 2009; USGS 2007).
13
14

15 Birds of Prey

16
17 Section 4.10.2.2.4 provided an overview of the birds of prey (raptors, owls, and vultures)
18 within the six-state solar study area. Raptor species that could occur within the proposed Bullard
19 Wash SEZ include the American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*),
20 prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), and turkey vulture
21 (*Cathartes aura*) (Arizona Field Ornithologists 2010; USGS 2007). Several other special status
22 birds of prey are discussed in Section 8.2.12. These include the American peregrine falcon
23 (*Falco peregrinus anatum*), bald eagle (*Haliaeetus leucocephalus*), ferruginous hawk (*Buteo*
24 *regalis*), long-eared owl (*Asio otus*), and burrowing owl.
25
26

27 Upland Game Birds

28
29 Section 4.10.2.2.5 provided an overview of the upland game birds (primarily pheasants,
30 grouse, quail, and doves) that occur within the six-state solar study area. Upland game species
31 that could occur within the proposed Bullard Wash SEZ include Gambel's quail (*Callipepla*
32 *gambelii*), mourning dove (*Zenaida macroura*), and white-winged dove (*Zenaida asiatica*)
33 (Arizona Field Ornithologists 2010; USGS 2007).
34
35

36 8.2.11.2.2 Impacts

37
38 The types of impacts birds could incur from construction, operation, and
39 decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any
40 such impacts would be minimized through the implementation of required programmatic design
41 features described in Appendix A, Section A.2.2, and through application of any additional
42 mitigation. Section 8.2.11.2.3, below, identifies design features of particular relevance to the
43 proposed Bullard Wash SEZ.
44

45 The assessment of impacts on bird species is based on available information on the
46 presence of species in the affected area, as presented in Section 8.2.11.2.1, following the analysis

1 approach described in Appendix M. Additional NEPA assessments and coordination with federal
2 or state natural resource agencies may be needed to address project-specific impacts more
3 thoroughly. These assessments and consultations could result in additional required actions to
4 avoid or mitigate impacts on birds (see Section 8.2.11.2.3).

5
6 In general, impacts on birds would result from habitat disturbance (i.e., habitat reduction,
7 fragmentation, and alteration), and from disturbance, injury, or mortality to individual birds.
8 Table 8.2.11.2-1 summarizes the magnitude of potential impacts on representative bird species
9 resulting from solar energy development in the proposed Bullard Wash SEZ. On the basis of the
10 impacts on birds summarized in Table 8.2.11.2-1, direct impacts on representative bird species
11 would be small for all bird species (ranging from a high of 0.5% for the horned lark to a low of
12 0.002% for the crissal thrasher (Table 8.2.11.2-1). Larger areas of potentially suitable habitats for
13 the bird species occur within the area of potential indirect effects (e.g., up to 3.1% of available
14 habitat for the horned lark and Say's phoebe). Indirect impacts on birds could result from surface
15 water and sediment runoff from disturbed areas, fugitive dust generated by project activities,
16 accidental spills, and harassment. These indirect impacts are expected to be negligible with
17 implementation of programmatic design features.

18
19 Decommissioning after operations cease could result in short-term negative impacts on
20 individuals and habitats within and adjacent to the SEZ. The negative impacts of
21 decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term
22 benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4
23 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of
24 particular importance for bird species would be the restoration of original ground surface
25 contours, soils, and native plant communities associated with desert scrub, playa, and wash
26 habitats.

27 28 29 ***8.2.11.2.3 SEZ-Specific Design Features and Design Feature Effectiveness***

30
31 The successful implementation of programmatic design features presented in Appendix
32 A, Section A.2.2, would reduce the potential for effects on birds. Indirect impacts could be
33 reduced to negligible levels by implementing programmatic design features, especially those
34 engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While
35 SEZ-specific design features important for reducing impacts on birds are best established when
36 project details are considered, one design feature can be identified at this time, as follows:

- 37
38 • For solar energy facilities within the SEZ, the requirements contained within
39 the 2010 Memorandum of Understanding between the BLM and USFWS to
40 promote the conservation of migratory birds will be followed.
- 41
42 • Take of golden eagles and other raptors should be avoided. Mitigation
43 regarding the golden eagle should be developed in consultation with the
44 USFWS and the Arizona Game and Fish Department. A permit may be
45 required under the Bald and Golden Eagle Protection Act.

TABLE 8.2.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Bullard Wash SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Neotropical Migrants						
Ash-throated flycatcher (<i>Myiarchus cinerascens</i>)	Common in scrub and woodland habitats including desert riparian and desert washes. Requires hole/cavity for nesting. Uses shrubs or small trees for foraging perches. About 4,804,300 acres ⁱ of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Black-tailed gnatcatcher (<i>Poliptila melanura</i>)	Nests in bushes mainly in wooded desert washes with dense mesquite, palo verde, ironwood, and acacia. Also occurs in desert scrub habitat. About 3,601,400 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	80,750 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 665 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,154 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Neotropical Migrants</i> (Cont.)						
Black-throated sparrow (<i>Amphispiza</i> <i>bilineata</i>)	Chaparral and desertscrub habitats with sparse to open stands of shrubs. Often in areas with scattered Joshua trees. Nests in thorny shrubs or cactus. About 4,473,400 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,835 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 699 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,154 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Brewer's sparrow (<i>Spizella breweri</i>)	Common in Mojave and Colorado deserts during winter. Occupies open desert scrub and cropland habitats. About 1,461,300 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	42,681 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 656 acres in area of indirect effect	26 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 2,291 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Neotropical Migrants</i> (Cont.)						
Cactus wren (<i>Campylorhynchus brunneicapillus</i>)	Desert (especially areas with cholla cactus or yucca), mesquite, arid scrub, coastal sage scrub, and trees in towns in arid regions. Nests in <i>Opuntia</i> spp.; twiggy, thorny trees and shrubs; and sometimes in buildings. Nests may be used as winter roost. About 2,995,900 acres of potentially suitable habitat occurs within the SEZ region.	1,021 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat) during construction and operations	53,583 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	117 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 2,352 acres in area of indirect effect	13 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,157 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Common poorwill (<i>Phalaenoptilus nuttallii</i>)	Scrubby and brushy areas, prairie, desert, rocky canyons, open woodlands, and broken forests. Mostly in arid and semiarid habitats. Nests in open areas on a bare site. About 4,256,400 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	76,293 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	25 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 510 acres in area of indirect effect	34 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 2,954 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Neotropical Migrants</i> (Cont.)						
Common raven (<i>Corvus corax</i>)	Occurs in most habitats. Trees and cliffs provide cover. Roosts primarily in trees. Nests on cliffs, bluffs, tall trees, or man-made structures. Forages in sparse, open terrain. About 4,995,000 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,453 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Costa's hummingbird (<i>Calypte costae</i>)	Desert and semidesert areas, arid brushy foothills, and chaparral. Main habitats are desert washes, edges of desert riparian and valley foothill riparian areas, coastal shrub, desert scrub, desert succulent shrub, lower-elevation chaparral, and palm oasis. Also in mountains, meadows, and gardens during migration and winter. Most common in canyons and washes when nesting. Nests are located in trees, shrubs, vines, or cacti. About 4,226,400 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Neotropical Migrants (Cont.)						
Crissal thrasher (<i>Toxostoma crissale</i>)	Desert and semidesert areas, arid brushy foothills, and chaparral. Main habitats are desert washes, edges of desert riparian and valley foothill riparian areas, coastal shrub, desert scrub, desert succulent shrub, lower-elevation chaparral, and palm oasis. Also in mountains, meadows, and gardens during migration and winter. Most common in canyons and washes when nesting. Nests are located in trees, shrubs, vines, or cacti. About 903,400 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) during construction and operations	208 acres of potentially suitable habitat (0.02% of available potentially suitable habitat)	2 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 39 acres in area of indirect effect	0.3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 24.7 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Gila woodpecker (<i>Melanerpes uropygialis</i>)	Prefers sparsely covered desert habitats containing large saguaro cacti. About 2,447,200 acres of potentially suitable habitat occurs within the SEZ region.	1,036 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	53,670 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	117 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) and 2,353 acres in area of indirect effect	13 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,175 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h	
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e		Within Access Road Corridor (Indirect and Direct Effects) ^f
Neotropical Migrants (Cont.)						
Greater roadrunner (<i>Geococcyx californianus</i>)	Desert scrub, chaparral, edges of cultivated lands, and arid open areas with scattered brush. Fairly common in desert habitats. Requires thickets, large bushes, or small trees for shade, refuge, and roosting. Usually nests low in trees, shrubs, or clumps of cactus. Rarely nests on ground. About 4,925,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,433 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,451 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Horned lark (<i>Eremophila alpestris</i>)	Common to abundant resident in a variety of open habitats. Breeds in grasslands, sagebrush, semidesert shrublands, and alpine tundra. During migration and winter, inhabits the same habitats other than tundra, and occurs in agricultural areas. Usually occurs where plant density is low and there are exposed soils. About 1,239,800 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	38,328 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	23 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 468 acres in area of indirect effect	24 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 2,130 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Neotropical Migrants (Cont.)</i>						
Ladder-backed woodpecker (<i>Picoides scalaris</i>)	Fairly common in Mojave and Colorado Deserts. Variety of habitats, including deserts, arid scrub, riparian woodlands, mesquite, scrub oak, pinyon-juniper woodlands. Digs nest hole in rotted stub or dead or dying branches of various trees. Also nests in saguaro, agave, yucca, fence posts, and utility poles. Nests on ledges; branches of trees, shrubs, and cactus; and holes in trees or walls. About 4,813,200 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Neotropical Migrants</i> (Cont.)						
Le Conte's thrasher (<i>Toxostoma leconteii</i>)	Open desert wash, alkali desert scrub, and desert succulent shrub habitats. Prefers to nest and forage in arroyos and washes lined with dense stands of creosotebush and salt bush. About 3,589,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	80,750 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 665 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,154 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Lesser nighthawk (<i>Chordeiles acutipennis</i>)	Open country, desert regions, scrub, savanna, and cultivated areas. Usually near water, including open marshes, salt ponds, large rivers, rice paddies, and beaches. Roosts on low perches or the ground. Nests in the open on bare sites. About 4,385,700 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,344 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	150 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,009 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b					Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f		
Neotropical Migrants (Cont.)							
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Open country with scattered trees and shrubs, savanna, desert scrub, desert riparian, Joshua tree, and occasionally open woodland habitats. Perches on poles, wires, or fence posts (suitable hunting perches are important aspect of habitat). Nests in shrubs and small trees. About 4,938,000 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.	
Lucy's warbler (<i>Vermivora luciae</i>)	Breeds most often in dense lowland riparian mesquite woodlands. Inhabits dry washes, riparian forests, and thorn forests during winter and migration. About 2,921,700 acres of potentially suitable habitat occurs within the SEZ region.	186 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) during construction and operations	42,485 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	12 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 232 acres in area of indirect effect	12 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,066 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.	

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Neotropical Migrants (Cont.)</i>						
Phainopepla (<i>Phainopepla nitens</i>)	Common in Mojave and Colorado deserts. Desert scrub, mesquite, juniper and oak woodlands, tall brush, washes, riparian woodlands, and orchards. Nests in dense foliage of large shrubs or trees, sometimes in a clump of mistletoe. About 3,550,500 acres of potentially suitable habitat occurs in the SEZ region.	186 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) during construction and operations	42,485 acres of potentially suitable habitat (1.2% of available potentially suitable habitat)	12 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 231 acres in area of indirect effect	12 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,066 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Say's phoebe (<i>Sayornis saya</i>)	Arid open country, deserts, sagebrush plains, dry barren foothills, canyons, cliffs, ranches, and rural homes. Nests in cliff crevices, holes in banks, sheltered ledges, tree cavities, under bridges and roofs, and in mines. About 1,251,400 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	38,193 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	23 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 468 acres in area of indirect effect	24 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 2,095 acres in area of indirect effect	Small overall impact. No mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Neotropical Migrants (Cont.)</i>						
Scott's oriole (<i>Icterus parisorum</i>)	Desert-facing slopes of mountains or semiarid plains between mountain ranges. Nests in trees or yuccas. About 1,217,200 acres of potentially suitable habitat occurs within the SEZ region.	36 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) during construction and operations	4,518 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	11 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 223 acres in area of indirect effect	2 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 189 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Verdin (<i>Auriparus flaviceps</i>)	Desert riparian, desert wash, desert scrub, and alkali desert scrub areas with large shrubs and small trees. Nests in shrubs, small trees, or cactus. About 4,102,700 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,863 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 699 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,161 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Birds of Prey						
American kestrel (<i>Falco sparverius</i>)	Occurs in most open habitats, in various shrub and early successional forest habitats, forest openings, and various ecotones. Perches on trees, snags, rocks, utility poles and wires, and fence posts. Uses cavities in trees, snags, rock areas, banks, and buildings for nesting and cover. About 3,380,400 acres of potentially suitable habitat occurs in the SEZ region.	1,072 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat) during construction and operations	58,189 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 2,576 acres in area of indirect effect	16 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,363 acres in area of indirect effect	Small overall impact.
Golden eagle (<i>Aquila chrysaetos</i>)	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 3,351,600 acres of potentially suitable habitat occurs in the SEZ region.	1,072 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat) during construction and operations	58,193 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 2,576 acres in area of indirect effect	16 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,363 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Birds of Prey (Cont.)						
Prairie falcon (<i>Falco mexicanus</i>)	Open habitats adjacent to cliffs or bluffs. Occurs mainly in desert grassland, chaparral, and creosotebush-bursage habitats. About 5,017,700 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,592 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,493 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Red-tailed hawk (<i>Buteo jamaicensis</i>)	Wide variety of habitats from deserts, mountains, and populated valleys. Open areas with scattered, elevated perch sites such as scrub desert, plains and montane grassland, agricultural fields, pastures urban parklands, broken coniferous forests, and deciduous woodland. Nests on cliff ledges or in tall trees. About 2,927,900 acres of potentially suitable habitat occurs in the SEZ region.	1,057 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	57,985 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	126 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 2,541 acres in area of indirect effect	15 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,339 acres in area of indirect effect	Small overall impact.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Birds of Prey (Cont.)						
Turkey vulture (<i>Cathartes aura</i>)	Occurs in open stages of most habitats that provide adequate cliffs or large trees for nesting, roosting, and resting. Migrates and forages over most open habitats. Will roost communally in trees, exposed boulders, and occasionally transmission line support towers. About 1,598,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	42,788 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 657 acres in area of indirect effect	27 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 2,308 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Upland Game Birds						
Gambel's quail (<i>Callipepla gambelii</i>)	Deserts, especially in areas with brushy or thorny growth, and adjacent cultivated areas. Usually occurs near water. Nests on the ground under cover of small trees, shrubs, and grass tufts. About 4,807,800 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. Avoid isolated wetlands. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Upland Game Birds</i> (Cont.)						
Mourning dove (<i>Zenaida macroura</i>)	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, deserts, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 5,000,500 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
White-winged dove (<i>Zenaida asiatica</i>)	Nests in low to medium height trees with dense foliage and fairly open ground cover. Feeds on wild seeds, grains, and fruit. About 3,860,200 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.15% of available potentially suitable habitat) during construction and operations	97,344 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	150 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,009 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,451 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

Footnotes on next page.

TABLE 8.2.11.2-1 (Cont.)

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- ^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- ^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 5,791 acres of direct effect within the SEZ was assumed.
- ^c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- ^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 5,791 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.
- ^e For transmission line development, direct effects were estimated within a 5-mi (8-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.
- ^f For access road development, direct effects were estimated within a 5-mi (8-km) long, 60-ft (18-m) access road ROW from the SEZ to the nearest existing state route, U.S. highway, or interstate. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor to the existing road, less the assumed area of direct effects.
- ^g Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^h Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ⁱ To convert acres to km^2 , multiply by 0.004047.

Sources: Arizona Field Ornithologists (2010); NatureServe (2010); CalPIF (2009); CDFG (2008); USGS (2004, 2005a, 2007).

- Wetland habitats, which could provide occasional watering and feeding sites for some bird species, should be avoided

If SEZ-specific design features are implemented in addition to programmatic design features, impacts on bird species could be reduced. However, as potentially suitable habitats for most of the bird species occur throughout much of the SEZ, additional species-specific mitigation of direct effects for those species would be difficult or infeasible.

8.2.11.3 Mammals

8.2.11.3.1 Affected Environment

This section addresses mammal species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed Bullard Wash SEZ. The list of mammal species potentially present in the SEZ area was determined from Hoffmeister (1986) and range maps and habitat information available from SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007). See Appendix M for additional information on the approach used. About 45 species of mammals have ranges that encompass the area of the proposed Bullard Wash SEZ (Hoffmeister 1986; USGS 2007); however, suitable habitats for a number of these species are limited or nonexistent within the SEZ (USGS 2007). Similar to the overview of mammals provided for the six-state solar energy study area (Section 4.10.2.3), the following discussion for the SEZ emphasizes big game and other mammal species that (1) have key habitats within or near the SEZ, (2) are important to humans (e.g., big game, small game, and furbearer species), and/or (3) are representative of other species that share important habitats.

Big Game

The big game species that could occur within the affected area of the proposed Bullard Wash SEZ include cougar (*Puma concolor*) and mule deer (*Odocoileus hemionus*) (Hoffmeister 1986; USGS 2007). Due to its special species status, the Nelson's bighorn sheep is addressed in Section 8.2.12.

Other Mammals

A number of small game and furbearer species occur within the area of the proposed Bullard Wash SEZ. Species that could occur within the area of the SEZ would include the American badger (*Taxidea taxus*), black-tailed jackrabbit (*Lepus californicus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), desert cottontail (*Sylvilagus audubonii*), gray fox (*Urocyon cinereoargenteus*), javelina or spotted peccary (*Pecari tajacu*), kit fox (*Vulpes macrotis*), ringtail (*Bassariscus astutus*), and striped skunk (*Mephitis mephitis*) (USGS 2007).

1 The nongame (small) mammal species generally include smaller-sized mammals such as
2 rodents, bats, and shrews. Species for which potentially suitable habitat occurs within the SEZ
3 include the Arizona pocket mouse (*Perognathus amplus*), Botta's pocket gopher (*Thomomys*
4 *bottae*), cactus mouse (*Peromyscus eremicus*), canyon mouse (*P. crinitis*), deer mouse (*P.*
5 *maniculatus*), desert pocket mouse (*Chaetodipus penicillatus*), desert shrew (*Notiosorex*
6 *crawfordi*), desert woodrat (*Neotoma lepida*), Merriam's pocket mouse (*Dipodomys merriami*),
7 round-tailed ground squirrel (*Spermophilus tereticaudus*), southern grasshopper mouse
8 (*Onychomys torridus*), and white-tailed antelope squirrel (*Ammospermophilus leucurus*)
9 (Hoffmeister 1986; USGS 2007). Bat species that may occur within the area of the SEZ include
10 the big brown bat (*Eptesicus fuscus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), California
11 myotis (*Myotis californicus*), silver-haired bat (*Lasionycteris noctivagans*), spotted bat (*Euderma*
12 *maculatum*), and western pipistrelle (*Pipistrellus hesperus*) (Hoffmeister 1986; USGS 2007).
13 However, roost sites for the bat species (e.g., caves, hollow trees, rock crevices, or buildings)
14 would be limited to absent within the SEZ. Several other special status bat species that could
15 occur within the SEZ area are addressed in Section 8.2.12.1.

16
17 Table 8.2.11.3-1 provides habitat information for representative mammal species that
18 could occur within the proposed Bullard Wash SEZ.

21 **8.2.11.3.2 Impacts**

22
23 The types of impacts mammals could incur from construction, operation, and
24 decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any
25 such impacts would be minimized through the implementation of required programmatic design
26 features described in Appendix A, Section A.2.2, and through application of any additional
27 mitigation. Section 8.2.11.3.3, below, identifies design features of particular relevance to
28 mammals for the proposed Bullard Wash SEZ.

29
30 The assessment of impacts on mammal species is based on available information on the
31 presence of species in the affected area as presented in Section 8.2.11.3.1 following the analysis
32 approach described in Appendix M. Additional NEPA assessments and coordination with state
33 natural resource agencies may be needed to address project-specific impacts more thoroughly.
34 These assessments and consultations could result in additional required actions to avoid or
35 mitigate impacts on mammals (see Section 8.2.11.3.3).

36
37 Table 8.2.11.3-1 summarizes the magnitude of potential impacts on select mammal
38 species resulting from solar energy development (with the inclusion of programmatic design
39 features) in the proposed Bullard Wash SEZ.

42 **Cougar**

43
44 Up to 5,791 acres (23.4 km²) of potentially suitable cougar habitat could be lost through
45 solar energy development within the proposed Bullard Wash SEZ. An additional 187 acres
46 (0.8 km²) could be lost by transmission line and access road development. Together, these

TABLE 8.2.11.3-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed Bullard Wash SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Big Game						
Cougar (<i>Puma concolor</i>)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. About 4,852,500 acres ⁱ of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,453 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Mule deer (<i>Odocoileus hemionus</i>)	Most habitats, including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provides abundant browse and cover. About 4,963,900 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,456 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Small Game and Furbearers						
American badger (<i>Taxidea taxus</i>)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Digs burrows in friable soils. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 4,088,600 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,859 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 699 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,161 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Black-tailed jackrabbit (<i>Lepus californicus</i>)	Open plains, fields, and deserts with scattered thickets or patches of shrubs. Also open, early stages of forests and chaparral habitats. Rests during the day in shallow depressions, and uses shrubs for cover. About 2,573,300 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	43,015 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	34 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 692 acres in area of indirect effect	32 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 2,336 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Small Game and Furbearers (Cont.)						
Bobcat (<i>Lynx rufus</i>)	Most habitats except subalpine coniferous forest and montane meadow grasslands. Most common in rocky country from deserts through ponderosa forests. About 2,456,400 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	42,880 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	34 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 692 acres in area of indirect effect	27 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 2,308 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Coyote (<i>Canis latrans</i>)	All habitats at all elevations. Least common in dense coniferous forest. Where human control efforts occur, they are restricted to broken, rough country with abundant shrub cover and a good supply of rabbits or rodents. About 4,487,200 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,886 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 665 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,188 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Small Game and Furbearers (Cont.)						
Desert cottontail (<i>Sylvilagus audubonii</i>)	Abundant to common in grasslands, open forests, and desert shrub habitats. Can occur in areas with minimal vegetation as long as adequate cover (e.g., rock piles, fallen logs, fence rows) is present. Thickets and patches of shrubs, vines, and brush also used as cover. About 4,714,100 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,974 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 699 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,188 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Gray fox (<i>Urocyon cinereoargenteus</i>)	Deserts, open forests, and brush. Prefers wooded areas, broken country, brushlands, and rocky areas. Tolerant of low levels of residential development. About 4,696,800 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,839 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	13 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 721 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,154 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b					Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f		
<i>Small Game and Furbearers (Cont.)</i>							
Javelina (spotted peccary) (<i>Pecari tajacu</i>)	Often in thickets along creeks and washes. Beds in caves, mines, boulder fields, and dense stands of brush. May visit a water hole on a daily basis. About 4,739,100 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.	
Kit fox (<i>Vulpes macrotis</i>)	Desert and semidesert areas with relatively open vegetative cover and soft soils. Seeks shelter in underground burrows. About 4,392,300 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,238 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	150 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,008 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,434 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.	

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
Small Game and Furbearers (Cont.)						
Ringtail (<i>Bassariscus astutus</i>)	Usually in rocky areas with cliffs or crevices for daytime shelter, desert scrub, chaparral, pine-oak and conifer woodlands. About 4,737,500 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,859 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 699 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,161 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Striped skunk (<i>Mephitis mephitis</i>)	Prefers semi-open country with woodland and meadows interspersed, brushy areas, bottomland woods. Frequently found in suburban areas. Dens often under rocks, logs, or buildings. About 4,708,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,863 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 699 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,161 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Nongame (small)</i>						
<i>Mammals</i>						
Arizona pocket mouse (<i>Perognathus amplus</i>)	Various desert scrub habitats. Sleeps and rears young in underground burrows. About 3,829,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,237 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	150 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,008 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,119 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Big brown bat (<i>Eptesicus fuscus</i>)	Most habitats from lowland deserts to timberline meadows. Roosts in hollow trees, rock crevices, mines, tunnels, and buildings. About 4,725,600 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,729 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 698 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,136 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Nongame (small)</i>						
<i>Mammals (Cont.)</i>						
Botta's pocket gopher (<i>Thomomys bottae</i>)	Variety of habitats, including shortgrass plains, oak savanna, agricultural lands, and deserts. Burrows are more common in disturbed areas such as roadways and stream floodplains. About 4,570,900 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,733 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 698 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,136 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Brazilian free-tailed bat (<i>Tadarida brasiliensis</i>)	Cliffs, deserts, grasslands, old fields, savannas, shrublands, woodlands, and suburban/urban areas. Roosts in buildings, caves, and hollow trees. May roost in rock crevices, bridges, signs, or cliff swallow nests during migration. Large maternity colonies inhabit caves, buildings, culverts, and bridges. About 4,739,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,892 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 698 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,177 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h	
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e		Within Access Road Corridor (Indirect and Direct Effects) ^f
<i>Nongame (small)</i>						
<i>Mammals (Cont.)</i>						
Cactus mouse (<i>Peromyscus eremicus</i>)	Variety of areas, including desert scrub, semidesert chaparral, desert wash, semidesert grassland, and cliff and canyon habitats. About 4,286,500 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
California myotis (<i>Myotis californicus</i>)	Desertscrub, semidesert shrublands, lowland riparian, swamps, riparian suburban areas, plains grasslands, scrub-grasslands, woodlands, and forests. Roosts in caves, mine tunnels, hollow trees, and loose rocks. About 4,587,600 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,863 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 699 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,161 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b					Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f		
<i>Nongame (small)</i>							
<i>Mammals (Cont.)</i>							
Canyon mouse (<i>Peromyscus crinitus</i>)	Associated with rocky substrates in a variety of habitats, including desert scrub, sagebrush shrublands, woodlands, cliffs and canyons, and volcanic rock and cinder lands. Source of free water not required. About 4,184,400 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	92,793 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	140 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 2,820 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,252 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.	
Deer mouse (<i>Peromyscus maniculatus</i>)	Tundra; alpine and subalpine grasslands; plains grasslands; open, sparsely vegetated deserts; warm temperate swamps and riparian forests; and Sonoran desert scrub habitats. About 4,729,900 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	80,753 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	35 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 698 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,143 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.	

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h	
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e		Within Access Road Corridor (Indirect and Direct Effects) ^f
<i>Nongame (small)</i>						
<i>Mammals (Cont.)</i>						
Desert pocket mouse (<i>Chaetodipus penicillatus</i>)	Sparsely vegetated sandy deserts. Prefers rock-free bottomland soils along rivers and streams. Sleeps and rears young in underground burrows. About 3,862,100 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.15% of available potentially suitable habitat) during construction and operations	97,367 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	150 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,009 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Desert shrew (<i>Notiosorex crawfordi</i>)	Usually in arid areas with adequate cover such as semiarid grasslands, shortgrass plains, desert scrub, chaparral slopes, shortgrass plains, oak savannas and woodlands, and alluvial fans. About 4,433,100 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,457 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	151 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,044 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h	
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e		Within Access Road Corridor (Indirect and Direct Effects) ^f
<i>Nongame (small)</i>						
<i>Mammals (Cont.)</i>						
Desert woodrat (<i>Neotoma lepida</i>)	Sagebrush scrub; chaparral; deserts and rocky slopes with scattered cactus, yucca, pine-juniper, or other low vegetation; creosotebush desert; Joshua tree woodlands; scrub oak woodlands, pinyon-juniper woodlands; and riparian zones. Most abundant in rocky areas with Joshua trees. Dens built of debris on ground, among cacti or yucca, along cliffs, among rocks, or occasionally in trees. About 4,116,200 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	92,903 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	140 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 2,821 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,269 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Merriam's kangaroo rat (<i>Dipodomys merriami</i>)	Plains grasslands, scrub-grasslands, desertscrub, shortgrass plains, oak and juniper savannahs, mesquite dunes, and creosote flats. About 4,464,600 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,344 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	150 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 3,009 acres in area of indirect effect	36 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,451 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h	
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e		Within Access Road Corridor (Indirect and Direct Effects) ^f
<i>Nongame (small)</i>						
<i>Mammals (Cont.)</i>						
Round-tailed ground squirrel (<i>Spermophilus tereticaudus</i>)	Low flat areas with desert shrubs and usually with sandy soils. Also in areas with coarse hard-packed sand and gravel, alkali sinks, and creosotebush communities. Burrows usually at base of shrubs. Avoids rocky hills. About 3,833,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.15% of available potentially suitable habitat) during construction and operations	97,364 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	150 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,009 acres in area of indirect effect	36 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,458 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Silver-haired bat (<i>Lasiurus noctivagans</i>)	Urban areas, chaparral, alpine and subalpine grasslands, forests, scrub-grassland, oak savannah, and desertscrub habitats. Roosts under bark, and in hollow trees, caves, and mines. Forages over clearings and open water. About 2,154,700 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	38,305 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	25 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 502 acres in area of indirect effect	24 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 2,102 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	
<i>Nongame (small)</i>						
<i>Mammals (Cont.)</i>						
Southern grasshopper mouse (<i>Onychomys torridus</i>)	Low, arid, shrub and semiscrub vegetation of deserts. About 3,875,600 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.15% of available potentially suitable habitat) during construction and operations	97,262 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	142 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,016 acres in area of indirect effect	28 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 3,452 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Spotted bat (<i>Euderma maculatum</i>)	Various habitats from desert to montane coniferous forests, mostly in open or scrub areas. Roosts in caves and cracks and crevices in cliffs and canyons. About 1,739,000 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	55,008 acres of potentially suitable habitat (3.2% of available potentially suitable habitat)	142 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 2,847 acres in area of indirect effect	28 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 2,417 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.2.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b				
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Transmission Line Corridor (Indirect and Direct Effects) ^e	Within Access Road Corridor (Indirect and Direct Effects) ^f	Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
<i>Nongame (small)</i>						
<i>Mammals (Cont.)</i>						
Western pipistrelle (<i>Parastrellus hesperus</i>)	Deserts and lowlands, desert mountain ranges, desert scrub flats, and rocky canyons. Roosts mostly in rock crevices, sometimes mines and caves, and rarely in buildings. Suitable roosts occur in rocky canyons and cliffs. Most abundant bat in desert regions. About 4,308,200 acres of potentially suitable habitat occurs in the SEZ region.	5,791 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	76,399 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	25 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 510 acres in area of indirect effect	34 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 2,982 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
White-tailed antelope squirrel (<i>Ammospermophilus leucurus</i>)	Low deserts, semidesert and montane shrublands, plateaus, and foothills in areas with sparse vegetation and hard gravelly surfaces. Spends its nights and other periods of inactivity in underground burrows. About 3,889,500 acres of potentially suitable habitat occurs within the SEZ region.	5,791 acres of potentially suitable habitat lost (0.15% of available potentially suitable habitat) during construction and operations	76,179 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	24 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 475 acres in area of indirect effect	34 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 2,947 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

Footnotes on next page.

TABLE 8.2.11.3-1 (Cont.)

-
- ^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- ^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 5,791 acres of direct effect within the SEZ was assumed.
- ^c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- ^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 5,791 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.
- ^e For transmission line development, direct effects were estimated within a 5-mi (8-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.
- ^f For access road development, direct effects were estimated within a 5-mi (8-km) long, 60-ft (18-m) access road ROW from the SEZ to the nearest existing state route, U.S. highway, or interstate. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor to the existing road, less the assumed area of direct effects.
- ^g Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^h Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ⁱ To convert acres to km², multiply by 0.004047.

Sources: CDFG (2008); Hoffmeister (1986); NatureServe (2010); USGS (2004, 2005a, 2007).

1 represent about 0.1% of potentially suitable cougar habitat within the SEZ region. Over 97,000
2 acres (392 km²) of potentially suitable cougar habitat occurs within the area of indirect effect for
3 the SEZ and transmission line. This is about 2.0% of potentially suitable cougar habitat within
4 the SEZ region. Overall, impacts on cougar from solar energy development in the SEZ would
5 be small.

6 7 8 **Mule Deer**

9
10 Up to 5,791 acres (23.4 km²) of potentially suitable mule deer habitat could be lost
11 through solar energy development within the proposed Bullard Wash SEZ. An additional
12 187 acres (0.8 km²) could be lost by transmission line and access road development. Together,
13 these represent about 0.1% of potentially suitable mule deer habitat within the SEZ region. Over
14 97,900 acres (3,926 km²) of potentially suitable mule deer habitat occurs within the area of
15 indirect effect for the SEZ and access road. This is about 2.0% of potentially suitable mule deer
16 habitat within the SEZ region. Overall, impacts on mule deer from solar energy development in
17 the SEZ would be small.

18 19 20 **Other Mammals**

21
22 Direct impacts on all other representative mammal species from solar energy
23 development within the proposed Bullard Wash SEZ would be small (Table 8.2.11.3-1). For all
24 of these species, up to 5,791 acres (23.4 km²) (0.1 to 0.3%) of potentially suitable habitat would
25 be lost. Direct impacts from transmission line and access road development for these species
26 would range from 49 to 187 acres (0.2 to 0.8 km²) (Table 8.2.11.3-1). Loss of potential habitat
27 to transmission line and access road development would be no more than 0.005% of potentially
28 suitable habitat within the SEZ region for any of these species. Larger areas of potentially
29 suitable habitats for these mammal species occur within the area of potential indirect effects
30 (i.e., from 1.7 to 3.2% of available habitat (Table 8.2.11.3-1).

31 32 33 **Summary**

34
35 Overall, impacts on mammal species would be small (Table 8.2.11.3-1). In addition to
36 habitat loss, other direct impacts on mammals could result from collision with vehicles and
37 infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and
38 sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental
39 spills, and harassment. These indirect impacts are expected to be negligible with implementation
40 of programmatic design features.

41
42 Decommissioning after operations cease could result in short-term negative impacts on
43 individuals and habitats within and adjacent to the SEZ. The negative impacts of
44 decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term
45 benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4
46 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of

1 particular importance for mammal species would be the restoration of original ground
2 surface contours, soils, and native plant communities associated with desert scrub, playa, and
3 wash habitats.

6 ***8.2.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness***

7
8 The implementation of required programmatic design features described in Appendix A,
9 Section A.2.2, would reduce the potential for effects on mammals. Specific mitigation measures
10 particularly important to reducing impacts on mammals are best established when project details
11 are being considered; however, the following SEZ-specific design features can be identified at
12 this time:

- 14 • The fencing around solar energy projects should not block the free movement
15 of mammals, particularly big game species.
- 17 • Wetland habitats, which could provide occasional watering and feeding sites
18 for some mammal species, should be avoided.

19
20 If these SEZ-specific design features are implemented in addition to programmatic design
21 features, impacts on mammals could be reduced. However, potentially suitable habitats for a
22 number of the mammal species occur throughout much of the SEZ; therefore, species-specific
23 mitigation of direct effects for those species would be difficult or infeasible.

26 **8.2.11.4 Aquatic Biota**

29 ***8.2.11.4.1 Affected Environment***

30
31 The proposed Bullard Wash SEZ is located in a desert valley where surface waters are
32 typically limited to intermittent washes that only contain water for short periods during or
33 following precipitation. No perennial or intermittent streams or water bodies are present in the
34 proposed Bullard Wash SEZ or within the area of direct effects associated with the proposed new
35 transmission line corridor and presumed new access road. Ephemeral streams cross the northern
36 side of the SEZ, but these drainages only contain water following rainfall and typically do not
37 support wetland or riparian habitats. There are several small wetlands located within the SEZ
38 (USFWS 2009). Although little data are available, desert wetlands are likely to be typically
39 dry except after rainfall and would not be expected to support aquatic habitat. Aquatic habitat
40 and communities are not likely to be present in the proposed Bullard Wash SEZ, although
41 opportunistic crustaceans and aquatic insect larvae adapted to desert conditions may be present
42 even under dry conditions (Levick et al. 2008). However, more detailed site survey data are
43 needed to characterize the aquatic biota, if present, in Bullard Wash SEZ.

44
45 No perennial streams or water bodies are present within the area of indirect effects
46 associated with the proposed Bullard Wash SEZ or the presumed new transmission line corridor

1 and access road. In addition, no intermittent surface waters are present within the area of indirect
2 effects associated with the proposed new transmission line corridor or access road. Bullard Wash
3 is an ephemeral stream that runs along the western side of the SEZ, 13 mi (21 km) of which are
4 within the area of indirect effects associated with the SEZ. Bullard Wash contains water only
5 after rainfall and flows into Alamo Lake. Fourteen miles (22 km) of Date Creek are also located
6 in the area of indirect effects. Date Creek is an intermittent stream north of the SEZ that receives
7 both groundwater and rainwater that it conveys to the Santa Maria River. Although typically dry,
8 such ephemeral and intermittent habitat may contain opportunistic crustaceans and aquatic insect
9 larvae. Common aquatic invertebrates in the below Alamo Lake include mayflies (*Baetis*),
10 caddisflies (*Hydroptila*), and chironomids (Shafroth and Beauchamp 2006), but these same
11 species may not be capable of tolerating ephemeral and intermittent conditions. Non-native
12 fish species such as mosquitofish (*Gambusia affinis*), centrachids, and bullhead catfish
13 (*Ictalurus* spp.) are common in Alamo Lake and the Santa Maria River. Native fish species
14 including longfin dace (*Agosia chrysogaster*), speckled dace (*Rhinichthys osculus*),
15 roundtail chub (*Gila robusta*), Gila mountain sucker (*Pantosteus clarki*), and desert sucker
16 (*Catostomus insignis*) are generally restricted to tributaries above Alamo Lake (Shafroth and
17 Beauchamp 2006). Although no data is available, it is possible that these species may also
18 occur in the lower reaches of Date Creek, given sufficient water. There are also several
19 wetlands throughout the area of indirect effects associated with the SEZ. However, only
20 those wetlands receiving groundwater would be expected to contain aquatic habitat.

21
22 Outside of the indirect effects area, but within 50 mi (80 km) of the proposed Bullard
23 Wash SEZ, are approximately 48 mi (77 km) of perennial streams and 653 mi (1051 km) of
24 intermittent streams. Approximately 12,095 acres (49 km²) of Alamo Lake are located in the
25 area of indirect effects more than 15 mi (24 km) from the proposed Bullard Wash SEZ. Yerba
26 Mansa Spring is a constructed wetland in the Bill Williams River drainage upstream of Alamo
27 Lake and contains introduced Gila topminnow (*Poeciliopsis occidentalis*), an endangered
28 species. Intermittent streams are the only surface water feature in the area of direct and indirect
29 effects, and their area represents approximately 4% of the total amount of intermittent stream
30 present in the 50-mi (80-km) SEZ region.

31 32 33 **8.2.11.4.2 Impacts**

34
35 Because surface water habitats are a unique feature in the arid landscape in the vicinity
36 of the proposed Bullard Wash SEZ, the maintenance and protection of such habitats may be
37 important to the survival of aquatic and terrestrial organisms. The types of impacts aquatic
38 habitats and biota could incur from the development of utility-scale solar energy facilities are
39 described in detail in Section 5.10.3. Aquatic habitats present on or near the locations selected
40 for construction of solar energy facilities could be affected in a number of ways, including
41 (1) direct disturbance, (2) deposition of sediments, (3) changes in water quantity, and
42 (4) degradation of water quality.

43
44 There are no permanent water bodies, streams, or wetlands present within the boundaries
45 of either the proposed Bullard Wash SEZ or the presumed new access road and transmission line
46 corridors, and consequently there would be no direct impacts on aquatic habitats from solar

1 energy development. There are also no perennial surface water features in the area of indirect
2 effects. Of the two intermittent and ephemeral streams present in the area of indirect effects,
3 Bullard Wash may contain aquatic biota when water is present, but it is typically dry and does
4 not support aquatic habitat or communities. However, Date Creek is spring fed and may contain
5 aquatic habitat and biota. Both streams also flow into perennial surface waters. Therefore,
6 disturbance of land areas within the SEZ for solar energy facilities could increase the transport
7 of soil into these streams via water- and airborne pathways, adversely affecting aquatic biota
8 and habitat both locally and further downstream. The introduction of waterborne sediments to
9 Date Creek and Bullard Wash could be minimized using common mitigation measures such
10 as settling basins, silt fences, or directing water draining from the developed areas away from
11 streams. It is unlikely any of the sediment from surface runoff or airborne dust associated with
12 ground disturbance within the SEZ would reach aquatic habitat, given the large distance from
13 the SEZ to the nearest stream (15 mi [24 km]).
14

15 In arid environments, reductions in the quantity of water in aquatic habitats are of
16 particular concern. Water quantity in aquatic habitats could also be affected if significant
17 amounts of surface water or groundwater are utilized for power plant cooling water, for washing
18 mirrors, or for other needs. The greatest need for water would occur if technologies employing
19 wet cooling, such as parabolic trough or power tower technologies, were developed at the site;
20 the associated impacts would ultimately depend on the water source used (including groundwater
21 from aquifers at various depths). There are no surface water habitats on the proposed Bullard
22 Wash SEZ that could be used to supply water needs. Water demands during normal operations
23 would most likely be met by withdrawing groundwater from wells constructed on-site, and given
24 that groundwater outflows support streams in the region (8.2.9.1.2), there is the potential that
25 groundwater withdrawals could reduce surface water levels in streams and wetlands outside of
26 the proposed SEZ and area of indirect effects and, as a consequence, potentially reduce habitat
27 size and connectivity and create more adverse environmental conditions for aquatic organisms
28 in those habitats. Additional details regarding the volume of water required and the types of
29 organisms present in potentially affected water bodies would be required in order to further
30 evaluate the potential for impacts from water withdrawals.
31

32 As described in Section 5.10.3, water quality in aquatic habitats could be affected by the
33 introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during site
34 characterization, construction, operation, or decommissioning/reclamation of a solar energy
35 facility. However, because construction activities occur at least 0.2 mi (0.3 km) from any surface
36 water features, the potential for introducing contaminants would be small, especially if the
37 appropriate mitigation measures are used.
38
39

40 ***8.2.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness***

41

42 The implementation of required programmatic design features described in Appendix A,
43 Section A.2.2, would greatly reduce or eliminate the potential for effects on aquatic biota and
44 aquatic habitats from development and operation of solar energy facilities. While some SEZ-
45 specific design features are best established when project details are being considered, a design
46 feature that can be identified at this time is as follows:
47

1 • Any wetlands within the SEZ should be avoided.

2

3

4

5

6

7

8

9

If this SEZ-specific design feature is implemented in addition to programmatic design features and if the utilization of water from groundwater or surface water sources is adequately controlled to maintain sufficient water levels in aquatic habitats, the potential impacts on aquatic biota and habitats from solar energy development at the proposed Bullard Wash SEZ would be negligible.

8.2.12 Special Status Species (Threatened, Endangered, Sensitive, and Rare Species)

This section addresses special status species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Bullard Wash SEZ. Special status species include the following types of species³:

- Species listed as threatened or endangered under the ESA;
- Species that are proposed for listing, under review, or are candidates for listing under the ESA;
- Species that are listed by the BLM as sensitive;
- Species that are listed by the State of Arizona⁴; and
- Species that have been ranked by the State of Arizona as S1 or S2, or species of concern by the USFWS; hereafter referred to as “rare” species.

Special status species known to occur within 50 mi (80 km) of the proposed Bullard Wash SEZ center (i.e., the SEZ region) were determined from natural heritage records available through NatureServe Explorer (NatureServe 2010), information provided by the ANHP (Schwartz 2009; ANHP 2010), SWReGAP (USGS 2004, 2005a, 2007), and the USFWS Environmental Conservation Online System (ECOS) (USFWS 2010a). Information reviewed consisted of county-level occurrences as determined from NatureServe, quad-level occurrences provided by the ANHP, as well as modeled land cover types and predicted suitable habitats for the species within the 50-mi (80-km) region as determined from SWReGAP. The 50-mi (80-km) SEZ region intersects La Paz, Maricopa, Mohave, and Yavapai Counties in Arizona. However, the SEZ (and affected area) occurs only in Yavapai County. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

8.2.12.1 Affected Environment

The affected area considered in the assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur). For the Bullard Wash SEZ, the area of direct effects included the SEZ and the portions of the assumed access road and transmission corridors where ground-disturbing activities are assumed to occur (refer to Section 8.2.1.2 for development assumptions). The area of indirect effects was defined

³ See Section 4.6.4 for definitions of these species categories. Note that some of the categories of species included here do not fit BLM’s definition of special status species in BLM Manual 6840 (BLM 2008c). These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

⁴ State-listed species for the state of Arizona are those plants protected under the Arizona Native Plant Law or wildlife listed by the AZGFD as Wildlife Species of Special Concern (WSC).

1 as the area within 5 mi (8 km) of the SEZ boundary and portions of the assumed access road and
2 transmission corridors where ground-disturbing activities would not occur but that could be
3 indirectly affected by activities in the area of direct effect. Indirect effects considered in the
4 assessment included effects from surface runoff, dust, noise, lighting, and accidental spills
5 from the SEZ, but do not include ground-disturbing activities. For the most part, the potential
6 magnitude of indirect effects would decrease with increasing distance away from the SEZ. This
7 area of indirect effect was identified on the basis of professional judgment and was considered
8 sufficiently large to bound the area that would potentially be subject to indirect effects. The
9 affected area includes both the direct and indirect effects areas.

10
11 In its scoping comments on the proposed Bullard Wash SEZ (Stout 2009), the USFWS
12 expressed concern that groundwater withdrawals associated with solar energy development on
13 the Bullard Wash SEZ may reduce the regional groundwater supply that supports spring-fed
14 aquatic habitats in the SEZ region for the Gila topminnow, a species listed as endangered under
15 the ESA. In particular, the USFWS identified Yerba Mansa Spring along the Santa Maria River
16 near Date Creek Ranch as suitable habitat for this species that may be affected by groundwater
17 withdrawals to serve development on the SEZ. In addition, aquatic habitat in the Tres Alamos
18 Spring system, which occurs approximately 5 mi (8 km) north of the SEZ historically provided
19 habitat for the Gila topminnow and the desert pupfish—another fish species listed as endangered
20 under the ESA. This spring system is within the above-defined area of indirect effects and could
21 also be affected by groundwater withdrawals to serve solar energy development on the SEZ. For
22 these reasons, the analysis in this section includes these spring systems (Figure 8.2.12.1-1).
23 Although the Yerba Mansa Spring system is outside of the affected area as defined above, it is
24 included in this evaluation because of the possible effect of groundwater withdrawals.

25
26 The primary land cover habitat type within the affected area is Sonora-Mojave creosote
27 desert scrub (see Section 8.2.10). Potentially unique habitats in the affected area in which special
28 status species may reside include desert washes and associated riparian habitats as well as
29 pinyon-juniper woodlands. There are no aquatic habitats known to occur on the SEZ or
30 anywhere within the area of direct effects. The only aquatic habitats known to occur within the
31 area of indirect effects are Bullard Wash, Date Creek, and Tres Alamos Spring. Bullard Wash
32 occurs south and west of the SEZ; Date Creek occurs north of the SEZ (Figure 8.2.12.1-1).

33
34 All special status species that are known to occur within the Bullard Wash SEZ region
35 (i.e., within 50 mi [80 km] of the center of the SEZ) are listed, with their status, nearest recorded
36 occurrence, and habitats in Appendix J. Of these species, there are 39 that could be affected by
37 solar energy development on the SEZ, based on recorded occurrences or the presence of
38 potentially suitable habitat in the area. These species, their status, and their habitats are presented
39 in Table 8.2.12.1-1. For many of the species listed in the table (especially plants), their predicted
40 potential occurrence in the affected area is based only on a general correspondence between
41 mapped SWReGAP land cover types and descriptions of species habitat preferences. This overall
42 approach to identifying species in the affected area probably overestimates the number of species
43 that actually occur in the affected area. For many of the species identified as having potentially
44 suitable habitat in the affected area, the nearest known occurrence is more than 20 mi (32 km)
45 away from the SEZ.

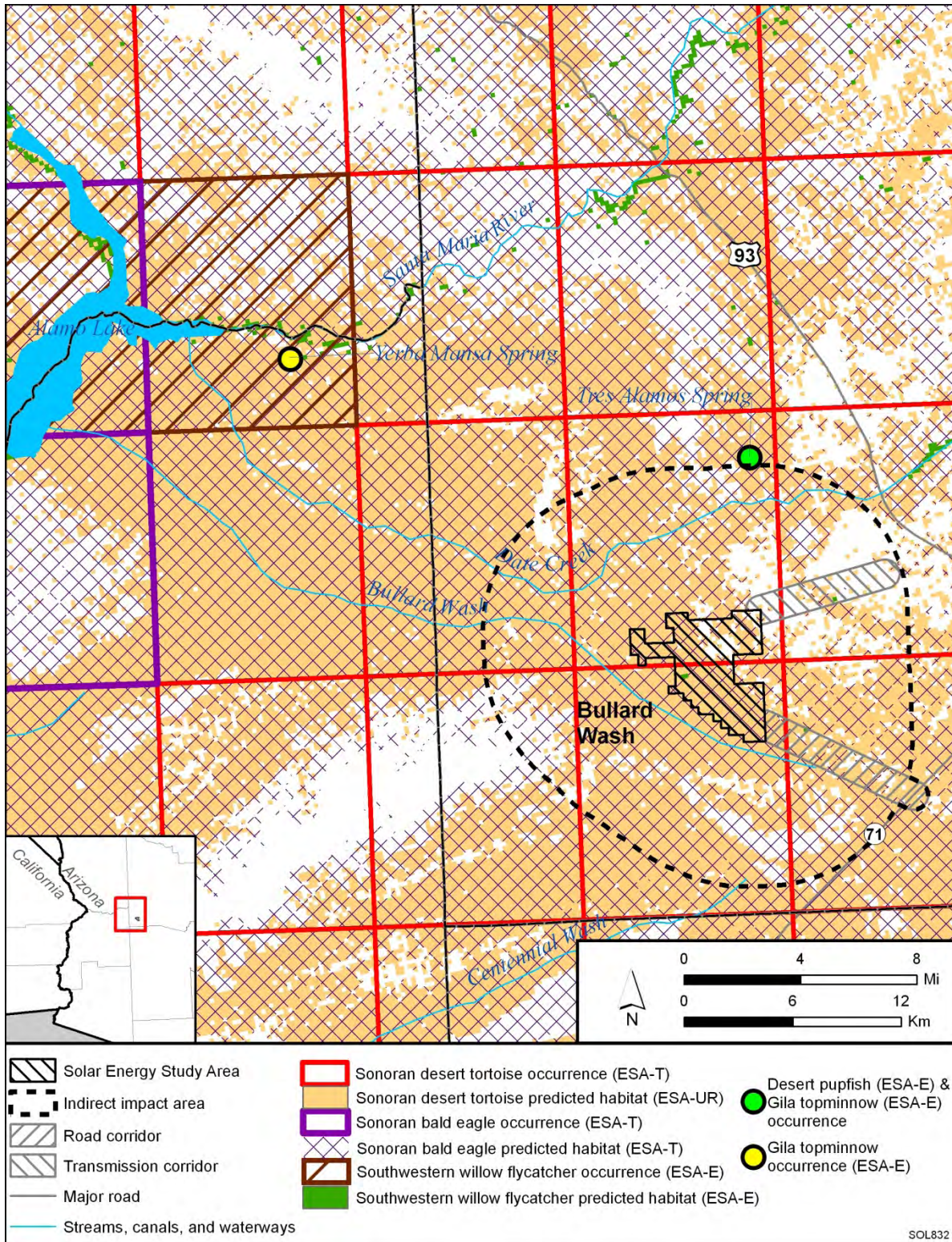


TABLE 8.2.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Bullard Wash SEZ

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Plants</i>								
Aravaipa wood fern	<i>Thelypteris puberula</i> var. <i>sonorensis</i>	BLM-S; AZ-S2	Moist soils in shady canyon regions, riparian habitats such as river banks, seepage areas, and mesic meadow habitats. Elevation ranges between 2,220 and 4,500 ft. ¹ Nearest quad-level occurrences are approximately 8 mi ¹ northwest of the SEZ. About 21,100 acres ^k of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitats in the area of direct effects could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Plants (Cont.) Arid tansy-aster	<i>Machaeranthera arida</i>	AZ-S1	Low sand dunes, alkaline flats, riverbanks, and sandy roadsides. Nearest quad-level occurrences are approximately 12 mi northwest of the SEZ. About 53,500 acres of potentially suitable habitat occurs within the SEZ region.	23 acres of potentially suitable riparian and disturbed habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	306 acres of potentially suitable riparian habitat (0.6% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitat in the area of direct effects could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Plants (Cont.)								
Arizona cliff rose	<i>Purshia subintegra</i>	ESA-E; AZ-HS; AZ-S1	Endemic to central Arizona near Horseshoe Lake (Maricopa County), Cottonwood (Yavapai County), Burro Creek (Mohave County), and Bylas (Graham County) in rolling, rocky, limestone hills and slopes within the creosotebush-crucifixion thorn habitat. Elevation ranges between 2,100 and 4,000 ft. Nearest quad-level occurrence is near Burro Creek, approximately 24 mi north of the SEZ. About 1,317,500 acres of potentially suitable habitat occurs within the SEZ region.	7,000 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	24 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	142 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	58,750 acres of potentially suitable habitat (4.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effects, translocation of individuals from areas of direct effects, or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Note that these same potential mitigations apply to all special status plants.
Arizona giant sedge	<i>Carex ultra</i>	BLM-S; AZ-S2	Shaded southeast-facing exposures of moist gravelly substrates near perennially wet springs and streams. Elevation ranges between 2,000 and 6,000 ft. Nearest quad-level occurrences are approximately 22 mi east of the SEZ. About 21,100 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitats in the area of direct effects could reduce impacts. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Plants (Cont.)								
Bigelow onion	<i>Allium bigelovii</i>	AZ-SR; AZ-S2	Gentle slopes on open, dry rocky soil in grassland, chaparral, and Sonoran–Mohave desert scrub communities. Elevation ranges between 2,000 and 5,000 ft. Nearest quad-level occurrences are from the Black Mountains approximately 10 mi north of the SEZ. About 1,685,400 acres of potentially suitable habitat occurs within the SEZ region.	6,150 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	24 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	40,400 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	Small overall impact. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.
Davidson sage	<i>Salvia davidsonii</i>	AZ-S2	Rocky substrates in canyons and in moist soils on wooded slopes, often on bedrock. Elevation ranges between 1,600 and 9,500 ft. Nearest quad-level occurrences are approximately 15 mi north of the SEZ. About 394,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	0 acres	158 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.
Golden barrel cactus	<i>Ferocactus cylindraceus</i> var. <i>eastwoodiae</i>	AZ-SR; AZ-S1	Endemic to central Arizona on gravelly or rocky hillsides, canyon walls, and wash margins. Elevation ranges between 1,200 and 4,000 ft. Nearest quad-level occurrences are approximately 15 mi north of the SEZ. About 4,250 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (3.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitat in the area of direct effects could reduce impacts. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Plants (Cont.)								
Hohokam agave	<i>Agave murpheyi</i>	BLM-S; AZ-HS; FWS-SC; AZ-S2	Endemic to Arizona and Sonora, Mexico, on benches or alluvial terraces on gentle bajada slopes above major drainages in desert scrub communities. Elevation ranges between 1,300 and 3,200 ft. Nearest quad-level occurrences are approximately 23 mi east of the SEZ. About 21,100 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitat in the area of direct effects could reduce impacts. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.
McKelvey's agave	<i>Agave mckelveyana</i>	AZ-SR	Endemic to Arizona in dry scrubland between 3,000 and 6,000 ft. Nearest quad-level occurrence is from the vicinity of Smith Canyon, approximately 34 mi northeast of the SEZ. About 3,497,000 acres of potentially suitable habitat occurs within the SEZ region.	7,150 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	142 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	97,450 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Plants (Cont.)								
Parish alkali grass	<i>Puccinellia parishii</i>	AZ-HS; FWS-SC; AZ-S2	Open saline areas on moist soils near springs. Elevation ranges between 2,780 and 7,350 ft. Nearest quad-level occurrence is approximately 25 mi north of the SEZ. About 21,100 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitat in the area of direct effects could reduce impacts. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.
Parish's phacelia	<i>Phacelia parishii</i>	BLM-S; AZ-S1	Moist to superficially dry, open, flat, mostly barren, salt-crust silty-clay soils on valley bottoms, lake deposits, and playa edges, often in close proximity to seepage areas surrounded by saltbush scrub vegetation. Elevation ranges between 2,200 and 5,950 ft. Nearest quad-level occurrence is approximately 24 mi north of the SEZ. About 21,100 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitat in the area of direct effects could reduce impacts. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Plants (Cont.)								
Pima Indian mallow	<i>Abutilon parishii</i>	BLM-S; AZ-SR; FWS-SC; AZ-S2	Mesic and riparian areas on hillsides, cliff bases, canyon bottoms, rocks and boulders, and washes. Elevation ranges between 1,720 and 4,900 ft. Nearest quad-level occurrence is approximately 24 mi north of the SEZ. About 21,100 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitat in the area of direct effects could reduce impacts. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.
Straw-top cholla	<i>Opuntia echinocarpa</i>	AZ-SR	Sandy or gravelly soil of benches, slopes, mesas, flats, and washes at elevations between 1,000 and 6,700 ft. Nearest quad-level occurrences are approximately 10 mi west of the SEZ. About 21,100 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitat in the area of direct effects could reduce impacts. See Arizona cliff rose for a list of potential mitigations applicable to all special status plant species.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Invertebrates</i> Maricopa tiger beetle	<i>Cicindela oregona maricopa</i>	FWS-SC	Known primarily from Maricopa County, Arizona, in sandy riparian areas such as streambanks and sand bars. Nearest quad-level occurrences are approximately 7 mi north of the SEZ. About 21,100 acres of potentially suitable habitat occurs within the SEZ region.	15 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	145 acres of potentially suitable riparian habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian or desert wash habitat in the area of direct effects could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Fish Desert pupfish^l	<i>Cyprinodon macularius</i>	ESA-E; AZ-WSC; AZ-S1	Colorado and Gila River drainages in desert springs and outflow marshes, river-edge marshes, backwaters, saline pools, and streams. Introduced in several locations in Graham, Santa Cruz, and Yavapai Counties. Historical quad-level occurrences intersect the SEZ, the transmission corridor, and portions of the area of indirect effects. Introduced into Tres Alamos Spring, approximately 5 mi north of the SEZ. However, currently considered extirpated from the SEZ region. About 21,500 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	0 acres	Less than 25 acres of historically occupied habitat (0.1% of available potentially suitable habitat)	Small to large overall impact; no direct effects. Historically occupied habitat for this species in Tres Alamos Spring may be affected by water withdrawals. Avoiding or limiting water withdrawals for solar energy development on the SEZ could reduce impacts on this species to negligible levels.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Fish (Cont.)</i> Gila topminnow	<i>Poeciliopsis occidentalis occidentalis</i>	ESA-E; AZ-WSC; AZ-S1	Gila River system, currently only at a few localities in the Gila River drainage and one locality in the Bill Williams drainage. Inhabits headwater springs and vegetated margins and backwater areas of intermittent and perennial streams and rivers. Historical quad-level occurrence intersects the affected area. Once occurred downstream of Tres Alamos Spring, approximately 5 mi north of the SEZ. This population is now considered extirpated. The nearest known population is known from Yerba Mansa Springs, approximately 15 mi northwest of the SEZ. About 21,500 acres of potentially suitable current, future, or historical habitat occurs within the SEZ region.	0 acres	0 acres	0 acres	Less than 50 acres of historically and currently occupied habitat (0.1% of available potentially suitable habitat)	Small to large overall impact; no direct effects. Historically occupied habitat for this species associated with Tres Alamos Spring and currently occupied habitat within the Yerba Mansa Springs may be affected by water withdrawals. Avoiding or limiting water withdrawals for solar energy development on the SEZ could reduce impacts on this species to negligible levels.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Amphibians Arizona toad	<i>Bufo microscaphus</i>	FWS-SC	Woodlands and low-elevation riparian habitats in association with permanent or semipermanent water bodies, including streams, ditches, flooded fields, irrigated croplands, and permanent reservoirs. Nearest quad-level occurrences are approximately 7 mi north of the SEZ. About 23,250 acres of potentially suitable habitat occurs within the SEZ region.	28 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	0 acres	0 acres	127 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian habitat in the area of direct effects could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Amphibians (Cont.)								
Lowland leopard frog	<i>Lithobates yavapaiensis</i>	BLM-S; AZ-WSC; FWS-SC	Aquatic systems in desert grasslands, pinyon-juniper woodlands, and agricultural areas, rivers, streams, beaver ponds, and springs. Man-made systems include earthen cattle tanks, livestock guzzlers, canals, and irrigation sloughs. Quad-level occurrences intersect the transmission corridor and portions of the area of indirect effects. About 395,450 acres of potentially suitable habitat occurs within the SEZ region.	560 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	4 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	9,400 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian habitats in the area of direct effects could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Reptiles								
Arizona night lizard	<i>Xantusia arizonae</i>	AZ-S1	Endemic to Arizona from Mohave, Pinal, and Yavapai Counties in arid and semiarid granite outcroppings and rocky areas, among fallen leaves, trunks of agave, or other vegetative debris. Associated with pinyon-juniper and chaparral-oak plant communities. Nearest quad-level occurrences are approximately 17 mi east of the SEZ. About 1,935,500 acres of potentially suitable habitat occurs within the SEZ region.	1,122 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	14 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	122 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	48,500 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Arizona skink	<i>Eumeces gilberti arizonensis</i>	AZ-WSC; FWS-SC; AZ-S1	Known only from west-central Arizona among rocks, logs, and leaf litter areas near permanent or semipermanent streams; riparian drainages up through oak-pine woodlands. Nearest quad-level occurrences are approximately 15 mi east of the SEZ. About 907,500 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	0 acres	114 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct effects. No species-specific mitigation is warranted.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Reptiles (Cont.)								
Desert rosy boa	<i>Charina trivirgata gracia</i>	BLM-S; FWS-SC	Arid scrublands, rocky deserts, and canyons with permanent or intermittent streams. Nearest quad-level occurrences are from the Santa Maria River, approximately 15 mi northwest of the SEZ. About 3,135,000 acres of potentially suitable habitat occurs within the SEZ region.	7,200 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	26 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	143 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	88,600 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Desert tortoise (Sonoran population)	<i>Gopherus agassizii</i>	ESA-UR; BLM-S; AZ-WSC	Mojave and Sonoran Deserts in desert creosotebush communities on firm soils for digging burrows, along riverbanks, washes, canyon bottoms, creosote flats, and desert oases. Quad-level occurrences intersect the SEZ, the road and transmission corridors, and portions of the area of indirect effects. About 2,775,500 acres of potentially suitable habitat occurs within the SEZ region.	6,225 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	29 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	32 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	75,200 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Mitigation measures should be developed in coordination with the USFWS and AZGFD.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Reptiles (Cont.) Gila monster	<i>Heloderma suspectum cinctum</i>	FWS-SC	Mojave and Sonoran Deserts in rocky, deeply incised topography and riparian habitat, desert scrub, thorn scrub, desert riparian, oak woodland, and semidesert grassland. On lower mountain slopes, rocky bajadas, canyon bottoms, and arroyos at elevations below 3,950 ft. Quad-level occurrences intersect the SEZ, the transmission corridor, and portions of the area of indirect effects. About 4,409,000 acres of potentially suitable habitat occurs within the SEZ region.	7,230 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	36 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	155 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	102,450 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mojave shovel-nosed snake	<i>Chionactis occipitalis occipitalis</i>	AZ-S1	Known only from Arizona in sparsely vegetated desert areas on rocky slopes, dunes, washes, and sandy flats. Quad-level occurrences intersect the road corridor and portions of the area of indirect effects. About 1,603,500 acres of potentially suitable habitat occurs within the SEZ region.	1,250 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	11 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	23 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	29,400 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds								
American peregrine falcon	<i>Falco peregrinus anatum</i>	BLM-S; AZ-WSC; FWS-SC	Year-round resident in the SEZ region. Open habitats, including deserts, shrublands, and woodlands that are associated with high, near vertical cliffs and bluffs above 200 ft. Forages in farmlands, marshes, lakes, rivers, and urban areas. Nearest quad-level occurrences are from the vicinity of Alamo Lake, approximately 18 mi northwest of the SEZ. About 4,963,500 acres of potentially suitable habitat occurs within the SEZ region.	7,230 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	36 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	155 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	102,500 acres of potentially suitable foraging habitat (2.1% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.
Bald eagle (Sonoran population)	<i>Haliaeetus leucocephalus</i>	ESA-T; BLM-S; AZ-WSC; AZ-S2	Winter resident in the SEZ region, most commonly along large bodies of water where fish and waterfowl prey are available. Occasionally forages in arid shrubland habitats. Nearest quad-level occurrences are from the vicinity of Alamo Lake, approximately 18 mi northwest of the SEZ. About 3,921,500 acres of potentially suitable habitat occurs within the SEZ region.	6,200 acres of potentially suitable foraging habitat lost (0.2% of available potentially suitable habitat)	31 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	23 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	79,600 acres of potentially suitable foraging habitat (2.0% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects. The potential for impact and need for mitigation should be determined in consultation with the USFWS and AZGFD.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds (Cont.)								
Ferruginous hawk	<i>Buteo regalis</i>	BLM-S; AZ-WSC; FWS-SC; AZ-S2	Winter resident in the SEZ region. Grasslands, sagebrush and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands. Nearest quad-level occurrence is from the vicinity of Boulder Creek, approximately 33 mi north of the SEZ. About 116,500 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	0 acres	14 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact on foraging habitat only; no direct effects. No species-specific mitigation is warranted.
Long-eared owl	<i>Asio otus</i>	AZ-S2	Winter resident in the SEZ affected area. Deciduous and evergreen forests, orchards, wooded parks, farm woodlots, riparian areas, and desert oases. Nests in trees in old nests of other birds or squirrels; sometimes nests in tree cavities. Nearest quad-level occurrence is 45 mi south of the SEZ. About 4,654,000 acres of potentially suitable habitat occurs within the SEZ region.	7,230 acres of potentially suitable foraging habitat lost (0.2% of available potentially suitable habitat)	34 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	144 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	97,900 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds (Cont.)								
Snowy egret	<i>Egretta thula</i>	BLM-S; AZ-WSC; AZ-S1	Year-round resident in the lower Colorado River Valley in open water areas such as marshes, estuaries, lagoons, lakes, ponds, rivers and flooded fields. Transient in affected area. Nearest quad-level occurrence is from the vicinity of the Hassayampa River, approximately 23 mi east of the SEZ. About 722,000 acres of potentially suitable habitat occurs within the SEZ region.	950 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	6 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	30 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	18,000 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small to large overall impact. No direct effects on nesting habitat. No species-specific mitigation of direct effects is feasible because the species is expected to only occur as a transient in the area of direct effects. Potentially suitable aquatic or riparian habitats for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting water withdrawals for solar energy development on the SEZ could reduce impacts on this species to negligible levels.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds (Cont.)								
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	ESA-E; AZ-WSC; AZ-S1	Summer breeding resident in the SEZ region. Riparian shrublands and woodlands. Nests in thickets, scrubby and brushy areas, open second growth, swamps, and open woodlands. Nearest quad-level occurrences are from Alamo Lake approximately 12 mi northwest of the SEZ. About 31,300 acres of potentially suitable habitat occurs within the SEZ region.	29 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	0 acres	0 acres	50 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable riparian habitats for this species may be directly affected on the SEZ or indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or minimizing disturbance to riparian habitats and avoiding or limiting water withdrawals for solar energy development on the SEZ could reduce impacts on this species to negligible levels. In addition, avoiding or minimizing disturbance to occupied habitat in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in consultation with the USFWS and AZGFD.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds (Cont.)								
Swainson's hawk	<i>Buteo swainsoni</i>	BLM-S; FWS-SC	Summer breeding resident in the SEZ region. Savanna, open pine-oak woodlands, grasslands, and cultivated lands. Nests in solitary trees, bushes, or small groves. Known to occur in Yavapai County, Arizona. About 1,880,500 acres of potentially suitable habitat occurs within the SEZ region.	156 acres of potentially suitable foraging or nesting habitat lost (<0.1% of available potentially suitable habitat)	7 acres of potentially suitable foraging or nesting habitat lost (<0.1% of available potentially suitable habitat)	7 acres of potentially suitable foraging or nesting habitat lost (<0.1% of available potentially suitable habitat)	32,300 acres of potentially suitable foraging or nesting habitat (1.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to potentially suitable nesting habitats (riparian woodland) could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied nesting habitat in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds (Cont.)								
Western burrowing owl	<i>Athene cunicularia hypugaea</i>	BLM-S; FWS-SC	Year-round resident in the SEZ region. Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dog, badger, etc.). Nearest quad-level occurrence is from the vicinity of Boulder Creek, approximately 33 mi north of the SEZ. About 3,971,500 acres of potentially suitable habitat occurs within the SEZ region.	7,230 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	36 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	153 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	102,650 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied burrows in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mammals								
California leaf-nosed bat	<i>Macrotus californicus</i>	BLM-S; AZ-WSC; FWS-SC	Year-round resident in SEZ region in desert riparian, desert wash, desert scrub, and palm oasis habitats at elevations below 2,000 ft. Roosts in mines, caves, and buildings. Quad-level occurrences intersect the SEZ, the road corridor, and portions of the area of indirect effects. About 3,131,500 acres of potentially suitable habitat occurs within the SEZ region.	7,230 acres of potentially suitable foraging habitat lost (0.2% of available potentially suitable habitat)	26 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	144 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	88,750 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact. No direct impact on roost habitat. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Mammals (Cont.)								
Cave myotis	<i>Myotis velifer</i>	FWS-SC	Lower Colorado River Basin in desert scrub, shrublands, washes, and riparian habitats. Roosts in colonies in caves. Quad-level occurrences intersect the SEZ, the road corridor, and portions of the area of indirect effects. About 4,186,000 acres of potentially suitable habitat occurs within the SEZ region.	6,200 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	31 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	23 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	79,600 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	Small overall impact. No direct impact on roost habitat. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	BLM-S; FWS-SC	Year-round resident in SEZ region near forests and shrubland habitats below 9,000-ft elevation throughout the SEZ region. Roosts and hibernates in caves, mines, and buildings. Nearest quad-level occurrence is from the vicinity of Burro Creek, approximately 28 mi northwest of the SEZ. About 4,440,500 acres of potentially suitable habitat occurs within the SEZ region.	6,200 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	31 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	23 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	79,800 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	Small overall impact. No direct impact on roost habitat. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Mammals (Cont.)								
Western red bat	<i>Lasiurus blossevillii</i>	BLM-S; AZ-WSC	Year-round resident in SEZ region. Forages in riparian and other wooded areas. Roosts primarily in cottonwood trees along riparian areas and in fruit orchards. Nearest quad-level occurrence is from the vicinity of the Hassayampa River, approximately 23 mi east of the SEZ. About 19,700 acres of potentially suitable habitat occurs within the SEZ region.	29 acres of potentially suitable foraging or roosting habitat lost (0.1% of available potentially suitable habitat)	0 acres	0 acres	141 acres of potentially suitable foraging or roosting habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian woodlands on the SEZ could reduce impacts on foraging or roosting habitat. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied roosts in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.2.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c				Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Transmission Line ROW (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Mammals (Cont.)								
Western yellow bat	<i>Lasiurus xanthinus</i>	BLM-S; AZ-WSC; AZ-S2	Year-round resident in the SEZ region in desert riparian, desert wash, and palm oasis habitats at elevations below 2,000 ft. Roosts in trees. Nearest quad-level occurrence is from the vicinity of the Hassayampa River, approximately 23 mi east of the SEZ. About 3,676,000 acres of potentially suitable habitat occurs within the SEZ region.	7,230 acres of potentially suitable foraging or roosting habitat lost (0.2% of available potentially suitable habitat)	36 acres of potentially suitable foraging or roosting habitat lost (<0.1% of available potentially suitable habitat)	154 acres of potentially suitable foraging or roosting habitat lost (<0.1% of available potentially suitable habitat)	102,300 acres of potentially suitable foraging or roosting habitat (2.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian woodlands on the SEZ could reduce impacts on foraging or roosting habitat. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied roosting areas in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Yuma myotis	<i>Myotis yumanensis</i>	FWS-SC	Year-round resident in the SEZ region in montane forest habitats at elevations between 2,000 and 8,000 ft. Roosts in buildings, mines, caves, and crevices. Nearest quad-level occurrences are from the vicinity of Alamo Lake, approximately 18 mi northwest of the SEZ. About 4,588,000 acres of potentially suitable habitat occurs within the SEZ region.	6,250 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	33 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	33 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	84,200 acres of potentially suitable foraging habitat (1.8% of available potentially suitable habitat)	Small overall impact. No direct impact on roost habitat. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.

Footnotes on next page.

TABLE 8.2.12.1-1 (Cont.)

-
- a AZ-S1 = ranked as S1 in the State of Arizona; AZ-S2 = ranked as S2 in the state of Arizona; AZ-SR = salvage restricted plant species under the Arizona Native Plant Law; AZ-WSC = listed as a wildlife species of concern in the State of Arizona; BLM-S = listed as a sensitive species by the BLM; ESA-T = listed as threatened under the ESA; ESA-UR = under review for listing under the ESA; FWS-SC = USFWS species of concern.
- b For plant species, potentially suitable habitat was determined by using SWReGAP land cover types. For terrestrial vertebrate species, potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- c Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area.
- d Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- e For access road development, direct effects were estimated within a 5-mi (8-km), 60-ft (18-m) wide road corridor from the SEZ to the nearest existing state or federal highway. For transmission ROW development, direct effects were estimated within a 5-mi (8-km), 250-ft (76-m) wide ROW from the SEZ to the nearest existing transmission line. Direct impacts within these areas were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide access road and transmission corridors.
- f Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portions of the access road and transmission corridors where ground-disturbing activities would not occur. Indirect effects include effects from groundwater withdrawal, surface runoff, dust, noise, lighting, and so on from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. Indirect effects on groundwater-dependent species were considered outside these defined areas.
- g Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- h Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- i To convert ft to m, multiply by 0.3048.
- j To convert mi to km, multiply by 1.609.
- k To convert acres to km^2 , multiply by 0.004047.
- l Species in bold text have been recorded or have designated critical habitat within 5 mi (8 km) of the SEZ boundary.

1 On the basis of ANHP records, quad-level occurrences for the following eight special
2 status species intersect the affected area of the Bullard Wash SEZ: desert pupfish, Gila
3 topminnow, lowland leopard frog, Sonoran desert tortoise, Gila monster, Mojave shovel-nosed
4 snake, California leaf-nosed bat, and cave myotis. These species are indicated in bold text in
5 Table 8.2.12.1-1.

6
7
8 **8.2.12.1.1 Species Listed under the Endangered Species Act That Could Occur**
9 **in the Affected Area**

10
11 In its scoping comments on the proposed Bullard Wash SEZ (Stout 2009), the USFWS
12 expressed concern for impacts of project development within the SEZ on suitable habitat for the
13 Gila topminnow—a species listed as endangered under the ESA. In addition to this species, there
14 are four other species listed under the ESA that have potentially suitable habitat within the
15 affected area: Arizona cliff rose (endangered), desert pupfish (endangered), Sonoran population
16 of the bald eagle (threatened), and southwestern willow flycatcher (endangered). Of these
17 species, the desert pupfish and Gila topminnow have historical quad-level occurrences within
18 the affected area in the Tres Alamos Spring system, approximately 5 mi (8 km) north of the
19 SEZ. These five species are discussed below, and information on their habitat is presented in
20 Table 8.2.12.1-1; additional basic information on life history, habitat needs, and threats to
21 populations of these species is provided in Appendix J.

22
23
24 **Arizona Cliff Rose**

25
26 The Arizona cliff rose is a perennial shrub endemic to central Arizona. This species is
27 currently listed as endangered under the ESA. This species occurs on rolling, rocky, limestone
28 hills, and slopes within Sonoran Desert scrub communities. This species inhabits a unique
29 plant community on limestone soils, which is commonly composed of creosotebush (*Larrea*
30 *tridentata*), Wright lippia (*Aloysia wrightii*), desert trumpet (*Baileya multiradiata*), snakeweed
31 (*Gutierrezia sarothrae*), Indian ricegrass (*Oryzopsis hymenoides*), and ocotillo (*Fouquieria*
32 *splendens*). The Arizona cliff rose occurs at elevations between 2,100 and 4,000 ft (640 and
33 1,220 m). The nearest known quad-level occurrence of this species is from the vicinity of Burro
34 Creek, approximately 24 mi (38 km) north of the SEZ. According to the SWReGAP land cover
35 model, potentially suitable desert scrub habitat may occur on the SEZ and within portions of the
36 affected area. Critical habitat for this species has not been designated.

37
38
39 **Desert Pupfish**

40
41 The desert pupfish is a small fish that is listed as endangered under the ESA. Natural
42 populations of this species have been extirpated from Arizona; however, populations have been
43 introduced in several locations in Graham, Santa Cruz, and Yavapai Counties. Within Arizona,
44 this species inhabits shallow waters of springs, small streams, and marshes at elevations below
45 4,920 ft (1,500 m). Historical quad-level occurrences of this species are known within the
46 affected area of the Bullard Wash SEZ in Tres Alamos Spring, approximately 5 mi (8 km) north

1 of the SEZ (Figure 8.2.12.1-1). This population is now considered extirpated, and the species is
2 not currently known to occur within the SEZ region. However, currently unoccupied, aquatic
3 habitat associated with the Tres Alamos Spring may represent potentially suitable habitat for this
4 species. Tres Alamos Spring is supported by groundwater that may also be used to support solar
5 energy development within the SEZ (Table 8.2.12.1-1). Designated critical habitat for this
6 species does not occur within the SEZ region.
7
8

9 **Gila Topminnow**

10
11 The Gila topminnow is a small fish that is listed as endangered under the ESA. Current
12 populations are known in Arizona from a few localities in the Gila River drainage and in one
13 locality in the Bill Williams River drainage. This species inhabits headwater springs and
14 vegetated margins and backwater areas of intermittent and perennial streams and rivers.
15 Historical quad-level occurrences of this species are known within the affected area of the
16 Bullard Wash SEZ in Tres Alamos Spring, approximately 5 mi (8 km) north of the SEZ
17 (Figure 8.2.12.1-1). This population is now considered extirpated. The nearest currently known
18 population is from Yerba Mansa Spring near the Santa Maria River, approximately 15 mi
19 (24 km) north of the SEZ. According to the USFWS (Stout 2009), this population in Yerba
20 Mansa Spring may be affected by project developments within the SEZ, especially if
21 groundwater withdrawals to serve development on the SEZ affect surface discharge in the spring
22 system. In addition, although currently unoccupied, aquatic habitat associated with Tres Alamos
23 Spring may represent potentially suitable habitat for this species. This spring is supported by
24 groundwater that may also be used to support solar energy development within the SEZ
25 (Table 8.2.12.1-1). Critical habitat for this species has not been designated.
26
27

28 **Sonoran Bald Eagle**

29
30 The Sonoran population of the bald eagle is currently listed as threatened under the
31 ESA, although recent findings by the USFWS have indicated that listing for this species is not
32 warranted (USFWS 2010b). According to ANHP records, the species is known to occur in the
33 vicinity of Alamo Lake, approximately 18 mi (29 km) northwest of the SEZ (Figure 8.2.12.1-1).
34 This species is primarily known to occur in riparian habitats associated with larger permanent
35 water bodies such as lakes, rivers, and reservoirs. However, it may occasionally forage in arid
36 shrubland habitats. According to the SWReGAP habitat suitability model, approximately
37 85,900 acres (348 km²) of potentially suitable winter foraging habitat for the Sonoran population
38 of the bald eagle may occur in the affected area of the Bullard Wash SEZ (Table 8.2.12.1-1).
39 Because there are no permanent surface water features and little riparian habitat (150 acres
40 [0.6 km²]) in the affected area, most of this potentially suitable foraging habitat is represented by
41 shrubland. Critical habitat has not been designated for this species.
42
43
44

1 **Southwestern Willow Flycatcher**
2

3 The southwestern willow flycatcher is a small neotropical migrant bird that inhabits
4 riparian shrublands, woodlands, and thickets in the southwestern United States. The nearest
5 recorded occurrence of this species is from Alamo Lake, approximately 12 mi (19 km) northwest
6 of the SEZ (Figure 8.2.12.1-1). Potentially suitable riparian habitats for breeding and foraging
7 may be dependent upon surface discharges from the regional groundwater system that may be
8 used to support solar energy development on the SEZ. According to the SWReGAP habitat
9 suitability model, approximately 29 acres (0.1 km²) of potentially suitable riparian habitat may
10 occur in the area of direct effects. Approximately 28 acres (0.1 km²) of potentially suitable
11 habitat may also occur within the area of indirect effects (Table 8.2.12.1-1). About 4,660 acres
12 (19 km²) of designated critical habitat for this species exists within the SEZ region outside of the
13 affected area approximately 35 mi (56 km) northwest of the SEZ along the Big Sandy River.
14

15
16 ***8.2.12.1.2 Species That Are Candidates for Listing under the ESA***
17

18 In its scoping comments on the proposed Bullard Wash SEZ (Stout 2009), the USFWS
19 did not express concern for impacts of project development within the SEZ on any species that
20 are candidates for listing under the ESA. There are no ANHP records or potentially suitable
21 habitats for any ESA candidate species within the affected area.
22

23
24 ***8.2.12.1.3 Species That Are under Review for Listing under the ESA***
25

26 In its scoping comments on the proposed Bullard Wash SEZ (Stout 2009), the USFWS
27 identified one species under ESA review that may be directly or indirectly affected by solar
28 energy development on the SEZ—the Sonoran population of the desert tortoise. This distinct
29 population segment of desert tortoise occurs south and east of the Colorado River (Mojave
30 populations north and west of the Colorado River are currently listed as threatened under the
31 ESA, but are outside of the affected area of the Bullard Wash SEZ). The Sonoran population
32 of the desert tortoise was petitioned for listing under the ESA on October 9, 2008 (WildEarth
33 Guardians and Western Watersheds Project 2008). Quad-level occurrences for this species
34 intersect the Bullard Wash SEZ and other portions of the affected area (Figure 8.2.12.1-1).
35 According to the SWReGAP land cover model, approximately 3,848 acres (16 km²) of
36 potentially suitable habitat for this species occurs on the SEZ; approximately 84,500 acres
37 (342 km²) of potentially suitable habitat occurs in the area of indirect effects (Table 8.2.12.1-1).
38 The USGS desert tortoise model (Nussear et al. 2009) does not encompass the same geographic
39 area as the Bullard Wash SEZ; however, BLM-developed Category I and Category III habitats
40 for the Sonoran desert tortoise exist immediately south of the SEZ. Category II habitats occur
41 north of the SEZ within the area of indirect effects. There are no BLM-developed habitat
42 categories on the SEZ, but Category III habitat does occur in the access road corridor. These
43 BLM habitat categories are used for BLM planning and land management (as reviewed in the
44 WildEarth Guardians and Western Watersheds Project [2008]). Category I habitats are the
45 most essential for the maintenance of large long-term populations; Category II habitats are
46 intermediate in the maintenance of large long-term populations; Category III habitats are not

1 essential to the maintenance of viable long-term populations and are identified to limit further
2 declines in the population size to the extent practical. Additional basic information on life
3 history, habitat needs, and threats to populations of these species is provided in Appendix J.
4
5

6 **8.2.12.1.4 BLM-Designated Sensitive Species**

7

8 A total of 17 BLM-designated sensitive species may occur in the affected area of the
9 Bullard Wash SEZ (Table 8.2.12.1-1). These BLM-designated sensitive include the following:
10 (1) plants—Aravaipa wood fern, Arizona giant sedge, Hohokam agave, Parish’s phacelia, and
11 Pima Indian mallow; (2) amphibian—lowland leopard frog; (3) reptile—desert rosy boa and
12 desert tortoise; (4) birds—American peregrine falcon, ferruginous hawk, snowy egret,
13 Swainson’s hawk, and western burrowing owl; and (5) mammals—California leaf-nosed bat,
14 Townsend’s big-eared bat, western red bat, and western yellow bat. Of these BLM-designated
15 sensitive species with potentially suitable habitat in the affected area, only quad-level
16 occurrences of the lowland leopard frog, desert tortoise, and California leaf-nosed bat intersect
17 the affected area of the Bullard Wash SEZ. Habitats in which BLM-designated sensitive species
18 are found, the amount of potentially suitable habitat in the affected area, and known locations of
19 the species relative to the SEZ are presented in Table 8.2.12.1-1. One of these species—the
20 Sonoran desert tortoise—has been previously discussed because it is being reviewed for listing
21 under the ESA (Section 8.2.12.1.3). All other BLM-designated sensitive species as related to the
22 SEZ are described in the remainder of this section. Additional life history information for these
23 species is provided in Appendix J.
24
25

26 **Aravaipa Wood Fern**

27

28 The Aravaipa wood fern is a perennial fern that is known from southern Arizona and
29 southeastern California. It occurs in shady canyon areas and along riparian habitats such as
30 washes, rivers, seeps, and meadows at elevations between 2,200 and 4,500 ft (670 and 1,372 m).
31 Nearest quad-level occurrences of this species are approximately 8 mi (13 km) northwest of the
32 SEZ. Although it is not known to occur in the affected area, potentially suitable desert wash and
33 riparian habitat may occur in the SEZ (Table 8.2.12.1-1).
34
35

36 **Arizona Giant Sedge**

37

38 The Arizona giant sedge is a perennial sedge that is known from Arizona and
39 southwestern New Mexico. It occurs in shady south-facing exposures of gravelly substrates near
40 springs and streams. Nearest quad-level occurrences of this species are approximately 22 mi
41 (35 km) east of the SEZ. Although it is not known to occur in the affected area, potentially
42 suitable desert wash and riparian habitat may occur in the SEZ and other portions of the affected
43 area (Table 8.2.12.1-1).
44
45
46

1 **Hohokam Agave**

2
3 The Hohokam agave is a perennial shrub endemic to Arizona and adjacent Sonora,
4 Mexico. It occurs on desert benches or alluvial terraces near bajadas, washes, or other major
5 drainages in desert scrub communities. Nearest quad-level occurrences of this species are
6 approximately 23 mi (37 km) east of the SEZ. Although it is not known to occur in the affected
7 area, potentially suitable desert wash and riparian habitat may occur in the SEZ and other
8 portions of the affected area (Table 8.2.12.1-1).

9
10
11 **Parish's Phacelia**

12
13 The Parish's phacelia is an annual forb that is known from Arizona, California, and
14 Nevada. It is a wetland-dependent species, occurring in moist to superficially dry soils in valley
15 bottoms, lake deposits, and playa edges. Nearest quad-level occurrences of this species are
16 approximately 24 mi (38 km) north of the SEZ. Although it is not known to occur in the affected
17 area, potentially suitable desert wash and riparian habitat may occur in the SEZ and other
18 portions of the affected area (Table 8.2.12.1-1).

19
20
21 **Pima Indian Mallow**

22
23 The Pima Indian mallow is a perennial shrub endemic to Arizona and adjacent Sonora,
24 Mexico. It occurs on hillsides, cliff bases, canyon bottoms, and washes. Nearest quad-level
25 occurrences of this species are approximately 24 mi (38 km) north of the SEZ. Although it is
26 not known to occur in the affected area, potentially suitable desert wash and riparian habitat
27 may occur in the SEZ and other portions of the affected area (Table 8.2.12.1-1).

28
29
30 **Lowland Leopard Frog**

31
32 The lowland leopard frog is a medium-sized frog primarily known from central and
33 southern Arizona, although the species is also known to occur in western New Mexico and
34 northern Mexico. It inhabits aquatic to mesic systems such as grasslands, pinyon-juniper forests,
35 agricultural areas, lakes, streams, and reservoirs. Nearest quad-level occurrences of this species
36 intersect the affected area of the Bullard Wash SEZ. Occurrences of this species are known from
37 Date Creek, as near as 5 mi (8 km) northeast of the SEZ. According to the SWReGAP habitat
38 suitability model, potentially suitable habitat for this species occurs on the SEZ and throughout
39 portions of the affected area (Table 8.2.12.1-1).

40
41
42 **Desert Rosy Boa**

43
44 The desert rosy boa is a snake known from Arizona and southeastern California. This
45 snake inhabits arid scrublands, rocky deserts, and canyons near washes or streams. Nearest quad-
46 level occurrences of this species are from the Santa Maria River, approximately 15 mi (24 km)

1 northwest of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable
2 habitat for this species occurs on the SEZ and throughout portions of the affected area
3 (Table 8.2.12.1-1).
4
5

6 **American Peregrine Falcon**

7

8 The American peregrine falcon is known throughout the western United States from areas
9 with high vertical cliffs and bluffs that overlook large open areas such as deserts, shrublands, and
10 woodlands. Nests are usually constructed on rock outcrops and cliff faces. Foraging habitat
11 varies from shrublands and wetlands to farmland and urban areas. Nearest recorded quad-level
12 occurrences of this species are from the vicinity of Alamo Lake, approximately 18 mi (29 km)
13 northwest of the SEZ (Table 8.2.12.1-1). According to the SWReGAP habitat suitability model,
14 potentially suitable year-round foraging and nesting habitat for the American peregrine falcon
15 may occur within the affected area of the Bullard Wash SEZ. However, on the basis of an
16 evaluation of SWReGAP land cover types, there is no suitable nesting habitat (cliffs or outcrops)
17 within the affected area.
18
19

20 **Ferruginous Hawk**

21

22 The ferruginous hawk is known to occur throughout the western United States.
23 According to the SWReGAP habitat suitability model, only potentially suitable winter foraging
24 habitat for this species may occur within the affected area of the Bullard Wash SEZ. This
25 species inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper
26 woodlands. Nearest recorded quad-level occurrences of this species are from the vicinity of
27 Boulder Creek, approximately 33 mi (53 km) north of the SEZ. According to the SWReGAP
28 habitat suitability model, suitable habitat for this species does not occur within the area of direct
29 effects; however, potentially suitable foraging habitat occurs in portions of the area of indirect
30 effects outside of the SEZ (Table 8.2.12.1-1).
31
32

33 **Snowy Egret**

34

35 The snowy egret is considered to be a year-round resident in the lower Colorado River
36 Valley in southwestern Arizona and southeastern California. This species is primarily associated
37 with open water areas such as marshes, lakes, ponds, and reservoirs. Nearest recorded quad-level
38 occurrences of this species are from the Hassayampa River, approximately 23 mi (37 km) east of
39 the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round
40 habitat may occur on the SEZ, access road and transmission corridors, as well as portions of the
41 area of indirect effects (Table 8.2.12.1-1). There are no permanent surface water features in the
42 affected area that may provide suitable habitat; therefore, this species may only occur in the area
43 of direct effects as a transient. However, aquatic and riparian habitats outside the area of direct
44 effects that may be potentially suitable for breeding and foraging could be dependent upon
45 surface discharges from the regional groundwater system that may be used to support solar
46 energy development on the SEZ.
47

1 **Swainson’s Hawk**

2
3 The Swainson’s hawk occurs throughout the southwestern United States. According to
4 the SWReGAP habitat suitability model, potentially suitable summer foraging or nesting habitat
5 may occur in the Bullard Wash SEZ region. This species inhabits desert, savanna, open pine-oak
6 woodland, grassland, and cultivated habitats. Nests are typically constructed in solitary trees,
7 bushes, or small groves. This species is known to occur in Yavapai County, Arizona, and
8 potentially suitable foraging habitat occurs in the area of direct effects and in other portions of
9 the affected area (Table 8.2.12.1-1). On the basis of an evaluation of SWReGAP land cover
10 types, approximately 15 acres (<0.1 km²) of riparian woodland habitat that may be potentially
11 suitable nesting habitat could occur on the SEZ. In addition to potentially suitable riparian
12 woodland habitats, approximately 155 acres (0.6 km²) of pinyon-juniper woodland habitat that
13 may be potentially suitable nesting habitat occurs in the area of indirect effects.
14

15
16 **Western Burrowing Owl**

17
18 The western burrowing owl is known to occur in the SEZ region, where it forages in
19 grasslands, shrublands, and open disturbed areas. According to the SWReGAP habitat suitability
20 model for the western burrowing owl, potentially suitable year-round foraging and nesting
21 habitat may occur in the affected area of the Bullard Wash SEZ. The species nests in burrows
22 usually constructed by mammals. Nearest recorded quad-level occurrences of this species are
23 from the vicinity of Boulder Creek, approximately 33 mi (53 km) north of the SEZ. Potentially
24 suitable foraging and breeding habitat is expected to occur in the area of direct effects and in
25 other portions of the affected area (Table 8.2.12.1-1). The availability of nest sites (burrows)
26 within the affected area has not been determined, but shrubland habitat that may be suitable for
27 either foraging or nesting occurs throughout the affected area.
28
29

30 **California Leaf-Nosed Bat**

31
32 The California leaf-nosed bat is a large-eared bat with a leaflike flap of protective skin on
33 the tip of its nose. It primarily occurs along the Colorado River from southern Nevada, through
34 Arizona and California, to Baja California and Sinaloa Mexico. The species forages in a variety
35 of desert habitats, including desert riparian, desert wash, desert scrub, and palm oasis. It roosts in
36 caves, crevices, and mines. Quad-level occurrences of this species intersect the affected area of
37 the Bullard Wash SEZ. According to the SWReGAP habitat suitability model, potentially
38 suitable year-round foraging habitat for this species may occur on the SEZ, portions of the access
39 road and transmission corridors, and throughout the affected area (Table 8.2.12.1-1). On the
40 basis of an evaluation of SWReGAP land cover types, however, there is no suitable roosting
41 habitat (rocky cliffs and outcrops) within the affected area.
42
43
44

1 **Townsend’s Big-Eared Bat**

2
3 The Townsend’s big-eared bat is a year-round resident in the Bullard Wash SEZ region
4 where it forages in a wide variety of desert and nondesert habitats. The species roosts in caves,
5 mines, tunnels, buildings, and other man-made structures. Nearest recorded occurrences of this
6 species are approximately 28 mi (45 km) northwest of the SEZ. According to the SWReGAP
7 habitat suitability model, potentially suitable year-round foraging habitat for this species may
8 occur on the SEZ, portions of the access road and transmission corridors, and throughout the
9 area of indirect effects (Table 8.2.12.1-1). On the basis of an evaluation of SWReGAP land
10 cover types, however, there is no suitable roosting habitat (rocky cliffs and outcrops) within the
11 affected area.
12

13
14 **Western Red Bat**

15
16 The western red bat is an uncommon year-round resident in the Bullard Wash SEZ
17 region where it forages in desert riparian and other woodland areas. This species may
18 occasionally forage in desert shrubland habitats. The species primarily roosts in cottonwood
19 trees in riparian areas. Nearest recorded occurrences of this species are from the Hassayampa
20 River, approximately 23 mi (37 km) east of the SEZ. According to the SWReGAP habitat
21 suitability model, potentially suitable year-round foraging habitat for this species may occur
22 on the SEZ and throughout portions of the affected area (Table 8.2.12.1-1). On the basis of
23 an evaluation of SWReGAP land cover types, approximately 15 acres (<0.1 km²) of riparian
24 woodland habitat that may be potentially suitable roosting habitat could occur on the SEZ.
25

26
27 **Western Yellow Bat**

28
29 The western yellow bat is an uncommon year-round resident in the Bullard Wash SEZ
30 region where it forages in desert riparian and desert oasis habitats. The species roosts in trees.
31 Nearest recorded occurrences of this species are from the Hassayampa River, approximately
32 23 mi (37 km) east of the SEZ. According to the SWReGAP habitat suitability model, potentially
33 suitable year-round foraging habitat for this species may occur on the SEZ, portions of the access
34 road and transmission corridors, and throughout the affected area (Table 8.2.12.1-1). On the
35 basis of an evaluation of SWReGAP land cover types, approximately 15 acres (<0.1 km²) of
36 riparian woodland habitat that may be potentially suitable roosting habitat could occur on the
37 SEZ.
38

39
40 **8.2.12.1.5 State-Listed Species**

41
42 There are 21 species listed by the State of Arizona that may occur in the Bullard
43 Wash SEZ affected area (Table 8.2.12.1-1). These state-listed species include the following:
44 (1) plants—Arizona cliff rose, Bigelow onion, golden barrel cactus, Hohokam agave,
45 McKelvey’s agave, Parish alkali grass, Pima Indian mallow, and straw-top cholla; (2) fish—
46 desert pupfish and Gila topminnow; (3) amphibian—lowland leopard frog; (4) reptiles—Arizona

1 skink and Sonoran desert tortoise; (5) birds—American peregrine falcon, Sonoran bald eagle,
2 ferruginous hawk, snowy egret, and southwestern willow flycatcher; and (5) mammals—
3 California leaf-nosed bat, western red bat, and western yellow bat. All of these species are
4 protected in Arizona under the Arizona Native Plant Law or by the AZGFD as Wildlife of
5 Special Concern (WSC). Of these species, the following six species have not been previously
6 described as ESA-listed (Section 8.2.12.1.1), under review for ESA listing (Section 8.2.12.1.3),
7 or BLM-designated sensitive (Section 8.2.12.1.4): Bigelow onion, golden barrel cactus,
8 McKelvey’s agave, Parish alkali grass, straw-top cholla, and Arizona skink. These species as
9 related to the SEZ are described in this section and Table 8.2.12.1-1. Additional life history
10 information for these species is provided in Appendix J.
11
12

13 **Bigelow Onion**

14
15 The Bigelow onion is a perennial herb known from central Arizona, southern
16 Nevada, and southwestern New Mexico. This species occurs on dry rocky slopes in grasslands,
17 chaparral, and Sonoran–Mojave desert scrub communities. Nearest quad-level occurrences
18 are from the Black Mountains approximately 10 mi (16 km) north of the Bullard Wash SEZ
19 (Table 8.2.12.1-1). According to the SWReGAP land cover model, potentially suitable desert
20 scrub habitat occurs within the SEZ, portions of the access road and transmission corridors, and
21 throughout the area of indirect effects.
22
23

24 **Golden Barrel Cactus**

25
26 The golden barrel cactus is endemic to central Arizona. This species occurs on rocky
27 hillsides, canyon walls, and in wash margins. Nearest quad-level occurrences are approximately
28 15 mi (24 km) north of the Bullard Wash SEZ (Table 8.2.12.1-1). According to the SWReGAP
29 land cover model, potentially suitable desert riparian habitat occurs within the SEZ and portions
30 of the area of indirect effects.
31
32

33 **McKelvey’s Agave**

34
35 The McKelvey’s agave is a perennial shrub endemic to central Arizona. This species
36 occurs in dry desert scrubland at elevations between 3,000 and 6,000 ft (915 and 1,830 m).
37 Nearest quad-level occurrences are approximately 15 mi (24 km) north of the Bullard Wash SEZ
38 (Table 8.2.12.1-1). According to the SWReGAP land cover model, potentially suitable desert
39 scrub habitat occurs within the SEZ, the access road and transmission corridors, and portions of
40 the area of indirect effects.
41
42

43 **Parish Alkali Grass**

44
45 The Parish alkali grass is an annual grass that is known from Arizona, California,
46 Nevada, and New Mexico. This species occurs in open saline areas on moist soils near springs.

1 Nearest quad-level occurrences are approximately 25 mi (40 km) north of the Bullard Wash SEZ
2 (Table 8.2.12.1-1). According to the SWReGAP land cover model, potentially suitable desert
3 riparian habitat occurs within the SEZ and portions of the area of indirect effects.
4
5

6 **Straw-Top Cholla**

7

8 The straw-top cholla is a perennial shrub-like cactus that is known from the southwestern
9 United States. This species occurs on sandy or gravelly soils on desert flats, mesas, and washes.
10 Nearest quad-level occurrences are approximately 10 mi (16 km) west of the Bullard Wash SEZ
11 (Table 8.2.12.1-1). According to the SWReGAP land cover model, potentially suitable desert
12 riparian habitat occurs on the SEZ and in portions of the area of indirect effects.
13
14

15 **Arizona Skink**

16

17 The Arizona skink is a subspecies of Gilbert’s skink (*Eumeces gilberti*) that is known
18 only from west–central Arizona. This species occurs in riparian and woodland areas among
19 logs, rocks, and leaf litter near streams. Nearest quad-level occurrences are approximately 15 mi
20 (24 km) east of the Bullard Wash SEZ (Table 8.2.12.1-1). According to the SWReGAP habitat
21 suitability model, potentially suitable habitat for this species does not occur anywhere within the
22 SEZ or within the access road or transmission corridors; however, some potentially suitable
23 habitat may occur in the area of indirect effects.
24
25

26 **8.2.12.1.6 Rare Species**

27

28 There are 34 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern
29 by the USFWS) that may be affected by solar energy development on the Bullard Wash SEZ
30 (Table 8.2.12.1-1). Of these species, 10 rare species have not been discussed previously. These
31 include the following: (1) plants—arid tansy-aster and Davidson sage; (2) invertebrate—
32 Maricopa tiger beetle; (3) amphibian—Arizona toad; (4) reptiles—Arizona night lizard, Gila
33 monster, and Mojave shovel-nosed snake; (5) bird—long-eared owl; and (6) mammals—cave
34 myotis and Yuma myotis. These species as related to the SEZ are described in Table 8.2.12.1-1.
35
36

37 **8.2.12.2 Impacts**

38

39 The potential for impacts on special status species from utility-scale solar energy
40 development within the proposed Bullard Wash SEZ is presented in this section. The types of
41 impacts that special status species could incur from construction and operation of utility-scale
42 solar energy facilities are discussed in Section 5.10.4.
43

44 The assessment of impacts on special status species is based on available information
45 on the presence of species in the affected area as presented in Section 8.2.12.1 following the
46 analysis approach described in Appendix M. It is assumed that, prior to development, surveys

1 would be conducted to determine the presence of special status species and their habitats in and
2 near areas where ground-disturbing activities would occur. Additional NEPA assessments, ESA
3 consultations, and coordination with state natural resource agencies may be needed to address
4 project-specific impacts more thoroughly. These assessments and consultations could result in
5 additional required actions to avoid, minimize, or mitigate impacts on special status species
6 (see Section 8.2.12.3).

7
8 Solar energy development within the Bullard Wash SEZ could affect a variety of habitats
9 (see Sections 8.2.9 and 8.2.10). These impacts on habitats could in turn affect special status
10 species that are dependent on those habitats. Based on ANHP records, quad-level occurrences
11 for the following eight species intersect the Bullard Wash affected area: desert pupfish, Gila
12 topminnow, lowland leopard frog, Sonoran desert tortoise, Gila monster, Mojave shovel-nosed
13 snake, California leaf-nosed bat, and cave myotis. Suitable habitat for the Gila topminnow,
14 snowy egret, and southwestern willow flycatcher is known to occur approximately 15 mi
15 (24 km) northwest of the SEZ boundary in spring-fed aquatic and riparian habitats near the
16 Yerba Mansa Spring and Santa Maria River that could be affected by groundwater withdrawals
17 from the Bullard Wash SEZ. Withdrawals from this regional groundwater system may also affect
18 aquatic and riparian habitat associated with the Tres Alamos Spring, approximately 5 mi (8 km)
19 north of the SEZ. Although currently unoccupied, this spring system represents historically
20 occupied habitat for the desert pupfish and the Gila topminnow. This spring system may also
21 support riparian habitat for the snowy egret and southwestern willow flycatcher. Withdrawals
22 from this regional groundwater system may be needed to support construction and operations
23 of solar energy facilities on the proposed Bullard Wash SEZ, which could in turn affect those
24 special status species with habitats that are dependent on groundwater. Other special status
25 species may occur on the SEZ or within the affected area based on the presence of potentially
26 suitable habitat. As discussed in Section 8.2.12.1, this approach to identifying the species that
27 could occur in the affected area probably overestimates the number of species that actually occur
28 in the affected area, and may therefore overestimate impacts on some special status species.

29
30 Potential direct and indirect impacts on special status species within the SEZ, access
31 road, and transmission corridors, and in the area of indirect effect outside the SEZ are presented
32 in Table 8.2.12.1-1. In addition, the overall potential magnitude of impacts on each species
33 (assuming programmatic design features are in place) is presented along with any potential
34 species-specific mitigation measures that could further reduce impacts.

35
36 Impacts on special status species could occur during all phases of development
37 (construction, operation, and decommissioning and reclamation) of a utility-scale solar energy
38 project within the SEZ. Construction and operation activities could result in short- or long-term
39 impacts on individuals and their habitats, especially if these activities are sited in areas where
40 special status species are known to or could occur. As presented in Section 8.2.1.2, it is assumed
41 that a new 5-mi (8-km) long access road and a 5-mi (8-km) long transmission ROW would be
42 created to connect existing infrastructure to the SEZ (Figure 8.2.12.1-1).

43
44 Direct impacts would result from habitat destruction or modification. It is assumed that
45 direct impacts would occur only within the SEZ, access road corridor, and transmission corridor
46 where ground-disturbing activities are expected to occur. Indirect impacts could result from

1 depletions of groundwater resources, surface water and sediment runoff from disturbed areas,
2 fugitive dust generated by project activities, accidental spills, harassment, and lighting. No
3 ground-disturbing activities associated with project developments are anticipated to occur within
4 the area of indirect effects. Decommissioning of facilities and reclamation of disturbed areas
5 after operations cease could result in short-term negative impacts on individuals and habitats
6 adjacent to project areas, but long-term benefits would accrue if original land contours and
7 native plant communities were restored in previously disturbed areas.
8

9 The successful implementation of programmatic design features (discussed in
10 Appendix A, Section A.2.2) would reduce direct impacts on some special status species,
11 especially those that depend on habitat types that can be easily avoided (e.g., desert riparian
12 habitats). Indirect impacts on special status species could be reduced to negligible levels by
13 implementing programmatic design features, especially those engineering controls that would
14 reduce groundwater consumption, runoff, sedimentation, spills, and fugitive dust.
15

16 ***8.2.12.2.1 Impacts on Species Listed under the ESA*** 17

18
19
20 In its scoping comments on the proposed Bullard Wash SEZ (Stout 2009), the USFWS
21 expressed concern for impacts of project development within the SEZ on suitable habitat for
22 the Gila topminnow—a species listed as endangered under the ESA. In addition to this species,
23 four other species listed under the ESA have potentially suitable habitat within the affected area:
24 Arizona cliff rose, desert pupfish, Sonoran population of the bald eagle, and southwestern willow
25 flycatcher. Impacts on these species are discussed below and summarized in Table 8.2.12.1-1.
26

27 **Arizona Cliff Rose** 28

29
30 The Arizona cliff rose is endemic to central Arizona and is currently listed as endangered
31 under the ESA. This species inhabits rocky slopes and hillsides in Sonoran Desert scrub
32 communities. This species is not known to occur within the affected area of the Bullard Wash
33 SEZ. However, on the basis of SWReGAP land cover types, approximately 7,000 acres (28 km²)
34 of potentially suitable desert scrub habitat on the SEZ, 24 acres (0.1 km²) of potentially suitable
35 desert scrub habitat in the access road corridor, and 142 acres (0.6 km²) of potentially suitable
36 desert scrub habitat in the transmission corridor could be directly affected by construction and
37 operations of solar energy development. This direct effects area represents about 0.5% of
38 available suitable habitat in the region. About 58,750 acres (238 km²) of suitable desert scrub
39 habitat occurs in the area of potential indirect effects; this area represents about 4.5% of the
40 available suitable habitat in the region (Table 8.2.12.1-1).
41

42 The overall impact on the Arizona cliff rose from construction, operation, and
43 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
44 considered small because the amount of potentially suitable habitat for this species in the
45 area of direct effects represents less than 1% of potentially suitable foraging habitat in the
46 SEZ region. The implementation of programmatic design features is expected to be sufficient
47 to reduce indirect impacts on this species to negligible levels.
48

1 Avoidance of all potentially suitable habitats for this species is not a feasible means of
2 mitigating impacts because these habitats (desert scrub) are widespread throughout the area of
3 direct effects. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied
4 habitats in the areas of direct effects would be the preferred method of mitigating impacts on
5 this species. If avoidance or minimization is not feasible, translocation of individuals from areas
6 of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce
7 impacts. Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
8 reasonable and prudent measures, and terms and conditions) on the Arizona cliff rose, including
9 development of a survey protocol, avoidance measures, minimization measures, and, potentially,
10 compensatory mitigation, would require consultation with the USFWS per Section 7 of the ESA.
11 These consultations may also be used to develop incidental take statements per Section 10 of the
12 ESA (if necessary). Consultation with AZGFD should also occur to determine any state
13 mitigation requirements.

14 15 16 **Desert Pupfish** 17

18 The desert pupfish is listed as endangered under the ESA, and natural populations of this
19 species are considered extirpated from Arizona. However, populations have been introduced in
20 several locations throughout the state, and the species once occurred in Tres Alamos Spring,
21 approximately 5 mi (8 km) north of the SEZ. Suitable habitat for this species does not occur in
22 the area of direct effects; however, indirect impacts on potentially suitable habitat in the Tres
23 Alamos Spring may be affected by groundwater withdrawals to serve development on the SEZ.
24 It is estimated that less than 25 acres (0.1 km²) of suitable aquatic habitat for this species exists
25 at Tres Alamos Spring. This habitat represents about 0.1% of available potentially suitable
26 habitat in the region. Other potentially suitable habitats throughout the region include the Bill
27 Williams River, Santa Maria River, and Alamo Lake.

28
29 Impacts of groundwater depletion from solar energy development in the Bullard Wash
30 SEZ cannot be quantified without identification of the cumulative amount of groundwater
31 withdrawals needed to support development on the SEZ. Consequently, the overall impact on the
32 desert pupfish could range from negligible to large and would depend in part on the solar energy
33 technology deployed, the scale of development within the SEZ, the type of cooling system used,
34 and the degree of influence water withdrawals in the SEZ would have on drawdown and surface
35 water discharges in habitats supporting these species (Table 8.2.12.1-1). Avoiding or limiting
36 groundwater withdrawals for solar energy development on the SEZ could reduce or eliminate
37 impacts on this species. Because the species is considered extirpated from the SEZ region, the
38 need for mitigation should first be discussed with the USFWS and AZGFD. If determined to be
39 necessary, consultation would identify actions to reduce impacts (e.g., reasonable and prudent
40 alternatives, reasonable and prudent measures, and terms and conditions) on the desert pupfish,
41 including avoidance measures, minimization measures, and, potentially, compensatory
42 mitigation. These consultations may also be used to develop incidental take statements per
43 Section 10 of the ESA (if necessary).

1 **Gila Topminnow**
2

3 The Gila topminnow is listed as endangered under the ESA, and natural populations of
4 this species are not known to occur within the SEZ region. However, populations have been
5 introduced in several locations throughout the state, and the species is known to occur in an
6 introduction site at Yerba Mansa Spring, approximately 15 mi (24 km) northwest of the SEZ.
7 The species also once occurred in Tres Alamos Spring, approximately 5 mi (8 km) north of the
8 SEZ. Suitable habitat for this species does not occur in the area of direct effects; however,
9 indirect impacts on potentially suitable habitat in the Tres Alamos and Yerba Mansa Springs may
10 be affected by groundwater withdrawals to serve development on the SEZ. It is estimated that
11 less than 50 acres (0.2 km²) of suitable aquatic habitat for this species exists in these two spring
12 systems. This habitat represents about 0.1% of available suitable habitat in the region. Other
13 potentially suitable habitats throughout the region include the Bill Williams River, Santa Maria
14 River, and Alamo Lake.
15

16 Impacts of groundwater depletion from solar energy development in the Bullard Wash
17 SEZ cannot be quantified without identification of the cumulative amount of groundwater
18 withdrawals needed to support development on the SEZ. Consequently, the overall impact on
19 the Gila topminnow could range from negligible to large and would depend in part on the solar
20 energy technology deployed, the scale of development within the SEZ, the type of cooling
21 system used, and the degree of influence water withdrawals in the SEZ would have on
22 drawdown and surface water discharges in habitats supporting these species (Table 8.2.12.1-1).
23 Avoiding or limiting groundwater withdrawals for solar energy development on the SEZ could
24 reduce or eliminate impacts on this species. Development of actions to reduce impacts
25 (e.g., reasonable and prudent alternatives, reasonable and prudent measures, and terms and
26 conditions) on the desert pupfish, including avoidance measures, minimization measures, and,
27 potentially, compensatory mitigation, would require consultation with the USFWS per Section 7
28 of the ESA. These consultations may also be used to develop incidental take statements per
29 Section 10 of the ESA (if necessary). Consultation with AZGFD should also occur to determine
30 any state mitigation requirements.
31
32

33 **Sonoran Bald Eagle**
34

35 The Sonoran population of the bald eagle is currently listed as threatened under the ESA⁵
36 and is known to occur in the vicinity of Alamo Lake, approximately 18 mi (29 km) northwest
37 of the SEZ (Figure 8.2.12.1-1). According to the SWReGAP habitat suitability model, only
38 winter foraging habitat is expected to occur in the affected area of the Bullard Wash SEZ.
39 Approximately 6,200 acres (25 km²) of potentially suitable foraging habitat within the SEZ,
40 31 acres (0.1 km²) of potentially suitable foraging habitat within the access road corridor, and
41 23 acres (0.1 km²) of potentially suitable foraging habitat within the transmission corridor could
42 be directly affected by construction and operations of solar energy development. This direct
43 effects area represents about 0.2% of available suitable habitat in the region. About 79,600 acres

⁵ A recent finding by the USFWS has indicated that listing of this species under the ESA is no longer warranted (USFWS 2010b).

1 (322 km²) of suitable foraging habitat occurs in the area of potential indirect effects; this area
2 represents about 2.0% of the available suitable habitat in the region (Table 8.2.12.1-1). On the
3 basis of SWReGAP land cover data, there are no permanent surface water features and little
4 riparian habitat (155 acres [0.6 km²]) in the affected area. Therefore, most of this potentially
5 suitable foraging habitat is desert shrubland.
6

7 The overall impact on the bald eagle from construction, operation, and decommissioning
8 of utility-scale solar energy facilities within the Bullard Wash SEZ is considered small because
9 the amount of potentially suitable foraging habitat for this species in the area of direct effects
10 represents less than 1% of potentially suitable foraging habitat in the SEZ region. The
11 implementation of programmatic design features is expected to be sufficient to reduce indirect
12 impacts on this species to negligible levels. Avoidance of potentially suitable foraging habitats
13 for this species is not a feasible means of mitigating impacts because these habitats (desert scrub)
14 are widespread throughout the area of direct effect and readily available in other portions of the
15 affected area.
16

17 Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
18 reasonable and prudent measures, and terms and conditions) on the Sonoran population of the
19 bald eagle, including development of a survey protocol, avoidance measures, minimization
20 measures, and, potentially, compensatory mitigation, would require consultation with the
21 USFWS per Section 7 of the ESA. These consultations may also be used to develop incidental
22 take statements per Section 10 of the ESA (if necessary). Consultation with AZGFD should also
23 occur to determine any state mitigation requirements.
24
25

26 **Southwestern Willow Flycatcher**

27

28 The southwestern willow flycatcher is listed as endangered under the ESA and is known
29 to occur near Alamo Lake, approximately 12 mi (<0.1 km) northwest of the SEZ. According to
30 the SWReGAP habitat suitability model, approximately 29 acres (0.1 km²) of potentially suitable
31 habitat on the SEZ could be directly affected by construction and operations of solar energy
32 development on the SEZ (Table 8.2.12.1-1). This direct effects area represents 0.1% of available
33 suitable habitat of the southwestern willow flycatcher in the region. About 50 acres (0.2 km²) of
34 suitable habitat occurs in the area of potential indirect effects; this area represents about 0.1% of
35 the available suitable habitat in the region (Table 8.2.12.1-1).
36

37 Riparian habitats on and in the vicinity of the Bullard Wash SEZ that may provide
38 suitable nesting and foraging habitat for the southwestern willow flycatcher may be influenced
39 by spring discharges associated with the regional groundwater system and may be affected by
40 groundwater withdrawals to serve development on the Bullard Wash SEZ. As discussed for the
41 desert pupfish and Gila topminnow, impacts on this species could range from small to large
42 depending upon the solar energy technology deployed, the scale of development within the
43 SEZ, and the cumulative rate of groundwater withdrawals (Table 11.2.12.1-1).
44

45 The implementation of programmatic design features, avoiding or minimizing
46 disturbance of riparian habitats in the area of direct effects, and avoidance or limitations of

1 groundwater withdrawals from the regional groundwater system could reduce impacts on the
2 southwestern willow flycatcher to small or negligible levels. Impacts can be better quantified for
3 specific projects once water needs are identified.
4

5 Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
6 reasonable and prudent measures, and terms and conditions) on the southwestern willow
7 flycatcher, including development of a survey protocol, avoidance measures, minimization
8 measures, and, potentially, compensatory mitigation, would require consultation with the
9 USFWS per Section 7 of the ESA. These consultations may also be used to develop incidental
10 take statements per Section 10 of the ESA (if necessary). Consultation with AZGFD should also
11 occur to determine any state mitigation requirements.
12
13

14 ***8.2.12.2 Impacts on Species That Are Candidates for Listing under the ESA***

15
16 In its scoping comments on the proposed Bullard Wash SEZ (Stout 2009), the USFWS
17 did not express concern for impacts of project development within the SEZ on any species that
18 are candidates for listing under the ESA. There are no ANHP records or potentially suitable
19 habitats for any ESA candidate species within the affected area.
20
21

22 ***8.2.12.3 Impacts on Species That Are under Review for Listing under the ESA***

23
24 In its scoping comments on the proposed Bullard Wash SEZ (Stout 2009), the
25 USFWS identified one species under ESA review that may be directly or indirectly affected
26 by solar energy development on the SEZ—the Sonoran population of the desert tortoise. This
27 distinct population segment of desert tortoise occurs south and east of the Colorado River
28 (Mojave populations north and west of the Colorado River are currently listed as threatened
29 under the ESA but are outside of the affected area of the Bullard Wash SEZ). Quad-level
30 occurrences for this species intersect the Bullard Wash SEZ and other portions of the affected
31 area (Figure 8.2.12.1-1). According to the SWReGAP habitat suitability model, approximately
32 6,225 acres (25 km²) of potentially suitable habitat on the SEZ, 29 acres (0.1 km²) of potentially
33 suitable habitat within the access road corridor, and 32 acres (0.1 km²) of potentially suitable
34 habitat within the transmission corridor could be directly affected by construction and operations
35 of solar energy development on the SEZ (Table 8.2.12.1-1). This direct effects area represents
36 about 0.2% of available suitable habitat of the desert tortoise in the region. About 75,200 acres
37 (304 km²) of suitable habitat occurs in the area of potential indirect effects; this area represents
38 about 2.7% of the available suitable habitat in the region (Table 8.2.12.1-1).
39

40 The overall impact on the Sonoran population of the desert tortoise from construction,
41 operation, and decommissioning of utility-scale solar energy facilities within the Bullard Wash
42 SEZ is considered small because the amount of potentially suitable habitat for this species in
43 the area of direct effects represents less than 1% of potentially suitable habitat in the region.
44 The implementation of programmatic design features alone is unlikely to reduce these impacts
45 to negligible levels. Avoidance of potentially suitable habitats for this species is not a feasible

1 means of mitigating impacts because these habitats (desert scrub) are widespread throughout the
2 area of direct effect.

3
4 Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
5 reasonable and prudent measures, and terms and conditions) for the desert tortoise, including
6 a survey protocol, avoidance measures, minimization measures, and, potentially, translocation
7 actions, and compensatory mitigation, should be conducted in coordination with the USFWS
8 and AZDFG.

9
10 There are inherent dangers to tortoises associated with their capture, handling, and
11 translocation from the SEZ. These actions, if done improperly, can result in injury or death. To
12 minimize these risks, the desert tortoise translocation plan should be developed in consultation
13 with the USFWS, and follow the *Guidelines for Handling Desert Tortoises during Construction*
14 *Projects* (Desert Tortoise Council 1994) and other current translocation guidance provided by the
15 USFWS or other state agencies. If considered appropriate, consultation will identify potentially
16 suitable recipient locations, density thresholds for tortoise populations in recipient locations,
17 procedures for pre-disturbance clearance surveys and tortoise handling, as well as disease testing
18 and post-translocation monitoring and reporting requirements. Despite some risk of mortality or
19 decreased fitness, translocation is widely accepted as a useful strategy for the conservation of the
20 desert tortoise (Field et al. 2007).

21
22 To offset impacts of solar development on the SEZ, compensatory mitigation may be
23 needed to balance the acreage of habitat lost with the acquisition of lands that would be
24 improved and protected for desert tortoise populations (USFWS 1994). Compensation can be
25 accomplished by improving the carrying capacity for the desert tortoise on the acquired lands.
26 Other mitigation actions may include funding for the enhancement of desert tortoise habitat on
27 existing federal lands. Coordination with the USFWS and AZGFD would be necessary to
28 determine the appropriate mitigation ratio to acquire, enhance, and preserve desert tortoise
29 compensation lands.

30 31 32 **8.2.12.2.4 Impacts on BLM-Designated Sensitive Species**

33
34 There are 16 BLM-designated sensitive species that are not previously discussed as listed
35 under the ESA or under review for ESA listing. Impacts on these BLM-designated sensitive
36 species that may be affected by solar energy development on the Bullard Wash SEZ are
37 discussed below.

38 39 **Aravaipa Wood Fern**

40
41
42 The Aravaipa wood fern is not known to occur in the affected area of the Bullard Wash
43 SEZ; however, approximately 15 acres (<0.1 km²) of potentially suitable riparian habitat on the
44 SEZ may be directly affected by construction and operations of solar energy development on the
45 SEZ (Table 8.2.12.1-1). This direct effects area represents about less than 0.1% of available
46 suitable habitat in the region. About 145 acres (0.6 km²) of potentially suitable riparian habitat

1 occurs in the area of potential indirect effects; this area represents about 0.7% of the available
2 suitable habitat in the region (Table 8.2.12.1-1).

3
4 The overall impact on the Aravaipa wood fern from construction, operation, and
5 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
6 considered small because less than 1% of potentially suitable habitat for this species occurs in
7 the area of direct effects. The implementation of programmatic design features is expected to be
8 sufficient to reduce indirect impacts to negligible levels.

9
10 Avoiding or minimizing disturbance to riparian habitats in the area of direct effects could
11 reduce direct impacts on this species to negligible levels. Alternatively, impacts could be reduced
12 by conducting pre-disturbance surveys and avoiding or minimizing disturbance of occupied
13 habitats in the area of direct effects. If avoidance or minimization is not a feasible option, plants
14 could be translocated from the area of direct effects to protected areas that would not be affected
15 directly or indirectly by future development. Alternatively, or in combination with translocation,
16 a compensatory mitigation plan could be developed and implemented to mitigate direct effects
17 on occupied habitats. Compensation could involve the protection and enhancement of existing
18 occupied or suitable habitats to compensate for habitats lost to development. A comprehensive
19 mitigation strategy that used one or more of these options could be designed to completely offset
20 the impacts of development.

21 22 23 **Arizona Giant Sedge**

24
25 The Arizona giant sedge is not known to occur in the affected area of the Bullard Wash
26 SEZ; however, approximately 15 acres (<0.1 km²) of potentially suitable riparian habitat on the
27 SEZ may be directly affected by construction and operations of solar energy development on the
28 SEZ (Table 8.2.12.1-1). This direct effects area represents about less than 0.1 % of available
29 suitable habitat in the region. About 145 acres (0.6 km²) of potentially suitable riparian habitat
30 occurs in the area of potential indirect effects; this area represents about 0.7% of the available
31 suitable habitat in the region (Table 8.2.12.1-1).

32
33 The overall impact on the Arizona giant sedge from construction, operation, and
34 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
35 considered small because less than 1% of potentially suitable habitat for this species occurs in
36 the area of direct effects. The implementation of programmatic design features is expected to be
37 sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to
38 riparian habitats in the area of direct effects and the implementation of other mitigation measures
39 described previously for the Aravaipa wood fern could reduce direct impacts on this species to
40 negligible levels. The need for mitigation, other than programmatic design features, should be
41 determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

1 **Hohokam Agave**

2
3 The Hohokam agave is not known to occur in the affected area of the Bullard Wash SEZ;
4 however, approximately 15 acres (<0.1 km²) of potentially suitable riparian habitat on the SEZ
5 may be directly affected by construction and operations of solar energy development on the SEZ
6 (Table 8.2.12.1-1). This direct effects area represents about less than 0.1% of available suitable
7 habitat in the region. About 145 acres (0.6 km²) of potentially suitable riparian habitat occurs in
8 the area of potential indirect effects; this area represents about 0.7% of the available suitable
9 habitat in the region (Table 8.2.12.1-1).

10
11 The overall impact on the Hohokam agave from construction, operation, and
12 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
13 considered small because less than 1% of potentially suitable habitat for this species occurs in
14 the area of direct effects. The implementation of programmatic design features is expected to be
15 sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to
16 riparian habitats in the area of direct effects and the implementation of other mitigation measures
17 described previously for the Aravaipa wood fern could reduce direct impacts on this species to
18 negligible levels. The need for mitigation, other than programmatic design features, should be
19 determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

20
21
22 **Parish's Phacelia**

23
24 The Parish's phacelia is not known to occur in the affected area of the Bullard Wash
25 SEZ; however, approximately 15 acres (<0.1 km²) of potentially suitable riparian habitat on the
26 SEZ may be directly affected by construction and operations of solar energy development on
27 the SEZ (Table 8.2.12.1-1). This direct effects area represents less than 0.1% of available
28 suitable habitat in the region. About 145 acres (0.6 km²) of potentially suitable riparian habitat
29 occurs in the area of potential indirect effects; this area represents about 0.7% of the available
30 suitable habitat in the region (Table 8.2.12.1-1).

31
32 The overall impact on the Parish's phacelia from construction, operation, and
33 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
34 considered small because less than 1% of potentially suitable habitat for this species occurs in
35 the area of direct effects. The implementation of programmatic design features is expected to be
36 sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to
37 riparian habitats in the area of direct effects and the implementation of other mitigation measures
38 described previously for the Aravaipa wood fern could reduce direct impacts on this species to
39 negligible levels. The need for mitigation, other than programmatic design features, should be
40 determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

41
42
43 **Pima Indian Mallow**

44
45 The Pima Indian mallow is not known to occur in the affected area of the Bullard Wash
46 SEZ; however, approximately 15 acres (<0.1 km²) of potentially suitable riparian habitat on the

1 SEZ may be directly affected by construction and operations of solar energy development on
2 the SEZ (Table 8.2.12.1-1). This direct effects area represents about less than 0.1% of available
3 suitable habitat in the region. About 145 acres (0.6 km²) of potentially suitable riparian habitat
4 occurs in the area of potential indirect effects; this area represents about 0.7% of the available
5 suitable habitat in the region (Table 8.2.12.1-1).
6

7 The overall impact on the Pima Indian mallow from construction, operation, and
8 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
9 considered small because less than 1% of potentially suitable habitat for this species occurs in
10 the area of direct effects. The implementation of programmatic design features is expected to be
11 sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to
12 riparian habitats in the area of direct effects and the implementation of other mitigation measures
13 described previously for the Aravaipa wood fern could reduce direct impacts on this species to
14 negligible levels. The need for mitigation, other than programmatic design features, should be
15 determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.
16
17

18 **Lowland Leopard Frog**

19

20 Quad-level occurrences for the lowland leopard frog intersect the affected area of the
21 Bullard Wash SEZ. Approximately 560 acres (2 km²) of potentially suitable habitat on the
22 SEZ, 4 acres (<0.1 km²) of potentially suitable habitat in the access road corridor, and 16 acres
23 (<0.1 km²) of potentially suitable habitat in the transmission corridor could be directly affected
24 by construction and operations (Table 8.2.12.1-1). This direct impact area represents about
25 0.1% of potentially suitable habitat in the SEZ region. About 9,400 acres (38 km²) of potentially
26 suitable habitat occurs in the area of indirect effects; this area represents about 2.4% of the
27 potentially suitable habitat in the SEZ region (Table 8.2.12.1-1).
28

29 The overall impact on the lowland leopard frog from construction, operation, and
30 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
31 considered small because the amount of potentially suitable habitat for this species in the area
32 of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The
33 implementation of programmatic design features is expected to be sufficient to reduce indirect
34 impacts to negligible levels.
35

36 Avoiding or minimizing disturbance to all aquatic and riparian habitats within the area of
37 direct effects could reduce impacts on this species to negligible levels. In addition, impacts could
38 be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to
39 occupied habitats in the area of direct effects. If avoidance or minimization is not a feasible
40 option, individuals could be translocated from the area of direct effects to protected areas that
41 would not be affected directly or indirectly by future development. Alternatively, or in
42 combination with translocation, a compensatory mitigation plan could be developed and
43 implemented to mitigate direct effects on occupied habitats. Compensation could involve the
44 protection and enhancement of existing occupied or suitable habitats to compensate for habitats
45 lost to development. A comprehensive mitigation strategy that used one or more of these options
46 could be designed to completely offset the impacts of development.
47

1 **Desert Rosy Boa**

2
3 The desert rosy boa is known to occur within the SEZ region, and potentially suitable
4 habitat is expected to occur in the affected area. Approximately 7,200 acres (29 km²) of
5 potentially suitable habitat on the SEZ, 26 acres (0.1 km²) of potentially suitable habitat in the
6 access road corridor, and 143 acres (0.6 km²) of potentially suitable habitat in the transmission
7 corridor could be directly affected by construction and operations (Table 8.2.12.1-1). This direct
8 impact area represents about 0.2% of potentially suitable habitat in the SEZ region. About
9 88,600 acres (359 km²) of potentially suitable habitat occurs in the area of indirect effects; this
10 area represents about 2.8% of the potentially suitable habitat in the SEZ region
11 (Table 8.2.12.1-1).

12
13 The overall impact on the desert rosy boa from construction, operation, and
14 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
15 considered small because the amount of potentially suitable foraging habitat for this species in
16 the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region.
17 The implementation of programmatic design features is expected to be sufficient to reduce
18 indirect impacts on this species to negligible levels.

19
20 Avoidance of all potentially suitable habitats to mitigate impacts on the desert rosy boa
21 is not feasible because potentially suitable desert scrub and wash habitats are widespread
22 throughout the area of direct effects. However, direct impacts could be reduced by conducting
23 pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area
24 of direct effects. If avoidance or minimization is not a feasible option, individuals could be
25 translocated from the area of direct effects to protected areas that would not be affected directly
26 or indirectly by future development. Alternatively, or in combination with translocation, a
27 compensatory mitigation plan could be developed and implemented to mitigate direct effects
28 on occupied habitats. Compensation could involve the protection and enhancement of existing
29 occupied or suitable habitats to compensate for habitats lost to development. A comprehensive
30 mitigation strategy that used one or more of these options could be designed to completely offset
31 the impacts of development.

32
33 **American Peregrine Falcon**

34
35 The American peregrine falcon is a year-round resident in the Bullard Wash SEZ region,
36 and potentially suitable foraging habitat is expected to occur in the affected area. Approximately
37 7,230 acres (29 km²) of potentially suitable habitat on the SEZ, 36 acres (0.1 km²) of potentially
38 suitable habitat in the access road corridor, and 155 acres (0.6 km²) of potentially suitable
39 habitat in the transmission corridor could be directly affected by construction and operations
40 (Table 8.2.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the
41 SEZ region. About 102,500 acres (415 km²) of potentially suitable habitat occurs in the area of
42 indirect effects; this area represents about 2.1% of the potentially suitable habitat in the SEZ
43 region (Table 8.2.12.1-1). Most of this area could serve as foraging habitat (open shrublands).
44 On the basis of SWReGAP land cover data, there is no suitable nesting habitat (cliffs or
45 outcrops) within the affected area.
46
47

1 The overall impact on the American peregrine falcon from construction, operation,
2 and decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
3 considered small because the amount of potentially suitable foraging habitat for this species in
4 the area of direct effects represents less than 1% of potentially suitable foraging habitat in the
5 SEZ region. The implementation of programmatic design features is expected to be sufficient to
6 reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable
7 foraging habitats to mitigate impacts on the American peregrine falcon is not feasible because
8 potentially suitable foraging habitats are widespread throughout the area of direct effects and
9 readily available in other portions of the affected area.

12 **Ferruginous Hawk**

14 The ferruginous hawk is a winter resident in the Bullard Wash SEZ region, and
15 potentially suitable foraging habitat is expected to occur in the affected area. According to the
16 SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ
17 or within the access road or transmission corridors. However, about 14 acres (<0.1 km²) of
18 potentially suitable foraging habitat occurs in the area of indirect effects; this area represents
19 about less than 0.1% of the potentially suitable habitat in the SEZ region (Table 8.2.12.1-1).

21 The overall impact on the ferruginous hawk from construction, operation, and
22 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
23 considered small because no potentially suitable habitat for this species occurs in the area of
24 direct effects, and only indirect effects are possible. The implementation of programmatic
25 design features is expected to be sufficient to reduce indirect impacts to negligible levels.

28 **Snowy Egret**

30 The snowy egret is a year-round resident in the Bullard Wash SEZ region, and potentially
31 suitable habitat is expected to occur in the affected area. According to the SWReGAP habitat
32 suitability model, approximately 950 acres (4 km²) of potentially suitable habitat on the SEZ,
33 6 acres (<0.1 km²) of potentially suitable habitat in the access road corridor, and 30 acres
34 (0.1 km²) of potentially suitable habitat in the transmission corridor could be directly affected
35 by construction and operations (Table 8.2.12.1-1). This direct impact area represents 0.1% of
36 potentially suitable habitat in the SEZ region. Approximately 18,000 acres (73 km²) of
37 potentially suitable habitat occurs in the area of indirect effects; this area represents about
38 2.5% of the potentially suitable habitat in the SEZ region (Table 8.2.12.1-1). Because there
39 are no permanent surface water features in the affected area that may provide suitable foraging
40 or nesting habitat, this species may occur in the affected area only as a transient.

42 The snowy egret is expected to occur only as a transient in the area of direct effects.
43 Aquatic and riparian habitats outside of the area of direct effects that may provide suitable
44 nesting and foraging habitat for this species may be influenced by spring discharges associated
45 with the regional groundwater system and may be affected by groundwater withdrawals to serve
46 development on the Bullard Wash SEZ. As discussed for the southwestern willow flycatcher

1 (Section 8.2.12.2.1), impacts on this species could range from small to large depending upon the
2 solar energy technology deployed, the scale of development within the SEZ, and the cumulative
3 rate of groundwater withdrawals (Table 8.2.12.1-1).
4

5 The implementation of programmatic design features and avoidance or limitations of
6 groundwater withdrawals from the regional groundwater system could reduce impacts on the
7 snowy egret to small or negligible levels. Impacts can be better quantified for specific projects
8 once water needs are identified. In addition, avoiding or minimizing disturbance to riparian areas
9 within the access road corridor would further reduce impacts.
10

11 **Swainson's Hawk**

12
13
14 According to the SWReGAP habitat suitability model, only potentially suitable summer
15 foraging or nesting habitat for the Swainson's hawk may occur in the Bullard Wash SEZ region.
16 Approximately 156 acres (0.6 km²) of potentially suitable habitat on the SEZ, 7 acres (<0.1 km²)
17 of potentially suitable habitat in the access road corridor, and 7 acres (<0.1 km²) of potentially
18 suitable habitat in the transmission corridor could be directly affected by construction and
19 operations (Table 8.2.12.1-1). This direct impact area represents less than 0.1% of potentially
20 suitable habitat in the SEZ region. About 32,300 acres (131 km²) of potentially suitable
21 habitat occurs in the area of indirect effects; this area represents about 1.7% of the potentially
22 suitable habitat in the SEZ region (Table 8.2.12.1-1). Most of this area could serve as foraging
23 habitat (open shrublands). On the basis of SWReGAP land cover data, approximately 15 acres
24 (<0.1 km²) of riparian woodland habitat that could provide suitable nesting habitat may occur on
25 the SEZ; however, the availability of suitable nesting habitat within the area of direct effects has
26 not been determined. In addition to riparian woodlands, approximately 155 acres (0.6 km²) of
27 pinyon-juniper woodland habitat that may be potentially suitable nesting habitat occurs in the
28 area of indirect effects.
29

30 The overall impact on the Swainson's hawk from construction, operation, and
31 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
32 considered small because the amount of potentially suitable habitat for this species in the area
33 of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ
34 region. The implementation of programmatic design features is expected to be sufficient to
35 reduce indirect impacts to negligible levels.
36

37 Avoidance of all potentially suitable habitats is not a feasible way to mitigate impacts
38 on the Swainson's hawk because potentially suitable desert scrub habitats are widespread
39 throughout the area of direct effect and readily available in other portions of the SEZ
40 region. Impacts on the Swainson's hawk could be reduced to negligible levels through the
41 implementation of programmatic design features and by conducting pre-disturbance surveys and
42 avoiding or minimizing disturbance to occupied nests in the area of direct effects. If avoidance or
43 minimization is not a feasible option, a compensatory mitigation plan could be developed and
44 implemented to mitigate direct effects on occupied habitats. Compensation could involve the
45 protection and enhancement of existing occupied or suitable habitats to compensate for habitats
46 lost to development. A comprehensive mitigation strategy that used one or both of these options

1 could be designed to completely offset the impacts of development. The need for mitigation,
2 other than programmatic design features, should be determined by conducting pre-disturbance
3 surveys for the species and its habitat in the area of direct effects.
4

6 **Western Burrowing Owl**

7
8 The western burrowing owl is a year-round resident in the Bullard Wash SEZ region,
9 and potentially suitable foraging and nesting habitat is expected to occur in the affected area.
10 Approximately 7,230 acres (29 km²) of potentially suitable habitat on the SEZ, 36 acres
11 (0.1 km²) of potentially suitable habitat in the access road corridor, and 153 acres (0.6 km²) of
12 potentially suitable habitat in the transmission corridor could be directly affected by construction
13 and operations (Table 8.2.12.1-1). This direct impact area represents 0.2% of potentially suitable
14 habitat in the SEZ region. About 102,650 acres (415 km²) of potentially suitable habitat occurs
15 in the area of indirect effects; this area represents about 2.6% of the potentially suitable habitat in
16 the SEZ region (Table 8.2.12.1-1). Most of this area could serve as foraging and nesting habitat
17 (shrublands). The abundance of burrows suitable for nesting in the affected area has not been
18 determined.
19

20 The overall impact on the western burrowing owl from construction, operation, and
21 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
22 considered small because the amount of potentially suitable habitat for this species in the area
23 of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The
24 implementation of programmatic design features is expected to be sufficient to reduce indirect
25 impacts to negligible levels.
26

27 Avoidance of all potentially suitable habitats is not a feasible way to mitigate impacts
28 on the western burrowing owl because potentially suitable desert scrub habitats are widespread
29 throughout the area of direct effect and readily available in other portions of the SEZ region.
30 Impacts on the western burrowing owl could be reduced to negligible levels through the
31 implementation of programmatic design features and by conducting pre-disturbance surveys
32 and avoiding or minimizing disturbance to occupied burrows in the area of direct effects. If
33 avoidance or minimization is not a feasible option, a compensatory mitigation plan could be
34 developed and implemented to mitigate direct effects on occupied habitats. Compensation could
35 involve the protection and enhancement of existing occupied or suitable habitats to compensate
36 for habitats lost to development. A comprehensive mitigation strategy that used one or both of
37 these options could be designed to completely offset the impacts of development. The need for
38 mitigation, other than programmatic design features, should be determined by conducting pre-
39 disturbance surveys for the species and its habitat in the area of direct effects.
40

42 **California Leaf-Nosed Bat**

43
44 The California leaf-nosed bat is a year-round resident within the Bullard Wash SEZ
45 region. On the basis of SWReGAP land cover data, suitable roosting habitats (caves and mines)
46 do not occur in the affected area. However, approximately 7,230 acres (29 km²) of potentially

1 suitable habitat on the SEZ, 26 acres (0.1 km²) of potentially suitable habitat in the access road
2 corridor, and 144 acres (0.6 km²) of potentially suitable habitat in the transmission corridor
3 could be directly affected by construction and operations (Table 8.2.12.1-1). This direct impact
4 area represents 0.2% of potentially suitable habitat in the SEZ region. About 88,750 acres
5 (359 km²) of potentially suitable foraging habitat occurs in the area of indirect effect; this area
6 represents about 2.8% of the available suitable foraging habitat in the region (Table 8.2.12.1-1).
7 The potentially suitable habitat in the affected area is foraging habitat represented by desert
8 shrubland. On the basis of an evaluation of SWReGAP land cover types, there are no potentially
9 suitable roosting habitats (rocky cliffs and outcrops) in the affected area.

10
11 The overall impact on the California leaf-nosed bat from construction, operation, and
12 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
13 considered small because the amount of potentially suitable habitat for this species in the area
14 of direct effects represents less than 1% of potentially suitable habitat in the region. The
15 implementation of programmatic design features may be sufficient to reduce indirect impacts on
16 this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a
17 feasible way to mitigate impacts because potentially suitable habitat is widespread throughout
18 the area of direct effects and readily available in other portions of the SEZ region.

21 **Townsend's Big-Eared Bat**

22
23 The Townsend's big-eared bat is a year-round resident within the Bullard Wash SEZ
24 region. On the basis of SWReGAP land cover data, suitable roosting habitats (caves and mines)
25 do not occur in the affected area. However, approximately 6,200 acres (25 km²) of potentially
26 suitable habitat on the SEZ, 31 acres (0.1 km²) of potentially suitable habitat in the access road
27 corridor, and 23 acres (0.1 km²) of potentially suitable habitat in the transmission corridor could
28 be directly affected by construction and operations (Table 8.2.12.1-1). This direct impact area
29 represents 0.1% of potentially suitable habitat in the SEZ region. About 79,800 acres (323 km²)
30 of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents
31 about 1.8 % of the available suitable foraging habitat in the region (Table 8.2.12.1-1). The
32 potentially suitable habitat in the affected area is foraging habitat represented by desert
33 shrubland. On the basis of an evaluation of SWReGAP land cover types, there are no potentially
34 suitable roosting habitats (rocky cliffs and outcrops) in the affected area.

35
36 The overall impact on the Townsend's big-eared bat from construction, operation,
37 and decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
38 considered small because the amount of potentially suitable habitat for this species in the area
39 of direct effects represents less than 1% of potentially suitable habitat in the region. The
40 implementation of programmatic design features may be sufficient to reduce indirect impacts on
41 this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a
42 feasible way to mitigate impacts because potentially suitable habitat is widespread throughout
43 the area of direct effects and readily available in other portions of the SEZ region.

1 **Western Red Bat**

2
3 The western red bat is an uncommon year-round resident within the Bullard Wash SEZ
4 region. On the basis of SWReGAP land cover data, suitable roosting habitats may occur in
5 riparian woodlands on the SEZ (15 acres [$<0.1 \text{ km}^2$]) or in other portions of the affected area.
6 Approximately 29 acres (0.1 km^2) of potentially suitable habitat on the SEZ could be directly
7 affected by construction and operations (Table 8.2.12.1-1). This direct impact area represents
8 0.1% of potentially suitable habitat in the SEZ region. Potentially suitable habitat does not occur
9 in the access road or transmission corridors. About 141 acres (0.6 km^2) of potentially suitable
10 foraging habitat occurs in the area of indirect effect; this area represents about 0.7% of the
11 available suitable foraging habitat in the region (Table 8.2.12.1-1). The potentially suitable
12 habitat in the affected area is primarily foraging habitat represented by desert shrubland. On
13 the basis of an evaluation of SWReGAP land cover types, approximately 15 acres ($<0.1 \text{ km}^2$)
14 of riparian woodland habitat that may be potentially suitable roosting habitat could occur on
15 the SEZ.

16
17 The overall impact on the western red bat from construction, operation, and
18 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
19 considered small because the amount of potentially suitable habitat for this species in the area
20 of direct effects represents less than 1% of potentially suitable foraging habitat in the region.
21 The implementation of programmatic design features may be sufficient to reduce indirect
22 impacts on this species to negligible levels.

23
24 Avoiding or minimizing disturbance to riparian woodland habitats in the area of direct
25 effects may reduce direct impacts on roosting habitat to negligible levels. Alternatively,
26 conducting pre-disturbance surveys and avoiding or minimizing disturbance to roost trees would
27 reduce potential impacts. Avoidance of all potentially suitable foraging habitats is not a feasible
28 way to mitigate impacts because potentially suitable habitat is widespread throughout the area of
29 direct effects and readily available in other portions of the SEZ region.

30
31
32 **Western Yellow Bat**

33
34 The western yellow bat is an uncommon year-round resident within the Bullard Wash
35 SEZ region. On the basis of SWReGAP land cover data, suitable roosting habitats may occur
36 in riparian woodlands on the SEZ (15 acres [$<0.1 \text{ km}^2$]) or in other portions of the affected
37 area. Approximately 7,230 acres (29 km^2) of potentially suitable habitat on the SEZ, 36 acres
38 (0.1 km^2) of potentially suitable habitat in the access road corridor, and 154 acres (0.6 km^2) of
39 potentially suitable habitat in the transmission corridor could be directly affected by construction
40 and operations (Table 8.2.12.1-1). This direct impact area represents 0.2% of potentially suitable
41 habitat in the SEZ region. About 102,300 acres (414 km^2) of potentially suitable foraging habitat
42 occurs in the area of indirect effect; this area represents about 2.8% of the available suitable
43 foraging habitat in the region (Table 8.2.12.1-1). The potentially suitable habitat in the affected
44 area is primarily foraging habitat represented by desert shrubland. On the basis of an evaluation
45 of SWReGAP land cover types, approximately 15 acres ($<0.1 \text{ km}^2$) of riparian woodland habitat
46 that may be potentially suitable roosting habitat could occur on the SEZ.

1 The overall impact on the western yellow bat from construction, operation, and
2 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
3 considered small because the amount of potentially suitable habitat for this species in the area
4 of direct effects represents less than 1% of potentially suitable foraging habitat in the region.
5 The implementation of programmatic design features may be sufficient to reduce indirect
6 impacts on this species to negligible levels.

7
8 Avoiding or minimizing disturbance to riparian woodland habitats in the area of direct
9 effects may reduce direct impacts on roosting habitat to negligible levels. Alternatively,
10 conducting pre-disturbance surveys and avoiding or minimizing disturbance to roost trees would
11 reduce potential impacts. Avoidance of all potentially suitable foraging habitats is not a feasible
12 way to mitigate impacts because potentially suitable habitat is widespread throughout the area of
13 direct effects and readily available in other portions of the SEZ region.

14 15 16 **8.2.12.2.5 Impacts on State-Listed Species**

17
18 A total of 21 species listed by the State of Arizona may occur in the Bullard Wash SEZ
19 affected area (Table 8.2.12.1-1). Of these species, impacts on the following 6 state-listed species
20 have not been previously described: Bigelow onion, golden barrel cactus, McKelvey's agave,
21 Parish alkali grass, straw-top cholla, and Arizona skink. Impacts on each of these 6 species are
22 discussed below and summarized in Table 8.2.12.1-1.

23 24 25 **Bigelow Onion**

26
27 The Bigelow onion is not known to occur in the affected area of the Bullard Wash SEZ;
28 however, according to the SWReGAP land cover model, potentially suitable desert scrub and
29 shrubland habitat may occur on the SEZ, within the access road or transmission corridors, and
30 throughout portions of the area of indirect effects. Approximately 6,150 acres (25 km²) of
31 potentially suitable habitat on the SEZ, 21 acres (0.1 km²) of potentially suitable habitat in the
32 access road corridor, and 24 acres (0.1 km²) of potentially suitable habitat in the transmission
33 corridor could be directly affected by construction and operations (Table 8.2.12.1-1). This
34 direct impact area represents 0.4% of potentially suitable habitat in the SEZ region. About
35 40,400 acres (163 km²) of potentially suitable habitat occurs in the area of indirect effect; this
36 area represents about 2.4% of the available suitable habitat in the region (Table 8.2.12.1-1).

37
38 The overall impact on the Bigelow onion from construction, operation, and
39 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
40 considered small because the amount of potentially suitable habitat for this species in the
41 area of direct effects represents less than 1% of potentially suitable habitat in the region. The
42 implementation of programmatic design features may be sufficient to reduce indirect impacts
43 on this species to negligible levels.

44
45 Avoidance of all potentially suitable habitats to mitigate impacts on the Bigelow onion is
46 not feasible because potentially suitable habitat (desert scrub) is widespread in the area of direct

1 effects and readily available throughout the SEZ region. For this species and other special
2 status plants, impacts could be reduced by conducting pre-disturbance surveys and avoiding
3 or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or
4 minimization is not a feasible option, plants could be translocated from areas of direct effects
5 to protected areas that would not be affected directly or indirectly by future development.
6 Alternatively, or in combination with translocation, a compensatory mitigation plan could be
7 developed and implemented to mitigate direct effects on occupied habitats. Compensation could
8 involve the protection and enhancement of existing occupied or suitable habitats to compensate
9 for habitats lost to development. A comprehensive mitigation strategy that uses one or more of
10 these options could be designed to completely offset the impacts of development.

13 **Golden Barrel Cactus**

15 The golden barrel cactus is not known to occur in the affected area of the Bullard Wash
16 SEZ; however, approximately 15 acres ($<0.1 \text{ km}^2$) of potentially suitable desert wash or riparian
17 habitat on the SEZ may be directly affected by construction and operations of solar energy
18 development on the SEZ (Table 8.2.12.1-1). This direct effects area represents about $<0.1\%$ of
19 available suitable habitat in the region. About 145 acres (0.6 km^2) of potentially suitable desert
20 wash or riparian habitat occurs in the area of potential indirect effects; this area represents about
21 0.7% of the available suitable habitat in the region (Table 8.2.12.1-1).

23 The overall impact on the golden barrel cactus from construction, operation, and
24 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
25 considered small because less than 1% of potentially suitable habitat for this species occurs in
26 the area of direct effects. The implementation of programmatic design features is expected to
27 be sufficient to reduce indirect impacts to negligible levels.

29 Avoiding or minimizing disturbance of desert riparian habitats in the area of direct effects
30 could reduce direct impacts on this species to negligible levels. Alternatively, impacts could be
31 reduced with the implementation of programmatic design features, and the other mitigation
32 options described previously for the Bigelow onion could reduce direct impacts on this species to
33 negligible levels. The need for mitigation, other than programmatic design features, should be
34 determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

37 **McKelvey's Agave**

39 The McKelvey's agave is not known to occur in the affected area of the Bullard Wash
40 SEZ; however, according to the SWReGAP land cover model, potentially suitable desert scrub
41 and shrubland habitat may occur on the SEZ, within the access road or transmission corridors,
42 and throughout portions of the area of indirect effects. Approximately 7,150 acres (29 km^2) of
43 potentially suitable habitat on the SEZ, 33 acres (0.1 km^2) of potentially suitable habitat in the
44 access road corridor, and 142 acres (0.6 km^2) of potentially suitable habitat in the transmission
45 corridor could be directly affected by construction and operations (Table 8.2.12.1-1). This
46 direct impact area represents 0.2% of potentially suitable habitat in the SEZ region. About

1 97,450 acres (394 km²) of potentially suitable habitat occurs in the area of indirect effect; this
2 area represents about 2.8% of the available suitable habitat in the region (Table 8.2.12.1-1).

3
4 The overall impact on the McKelvey's agave from construction, operation, and
5 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
6 considered small because the amount of potentially suitable habitat for this species in the
7 area of direct effects represents less than 1% of potentially suitable habitat in the region.
8 The implementation of programmatic design features may be sufficient to reduce indirect
9 impacts on this species to negligible levels.

10
11 Avoidance of potentially suitable habitat (desert scrub) in the area of direct effects is not
12 feasible because potentially suitable habitat is widespread throughout the area of direct effect.
13 However, impacts could be reduced with the implementation of programmatic design features,
14 and the mitigation options described previously for the Bigelow onion could reduce direct
15 impacts on this species to negligible levels. The need for mitigation, other than programmatic
16 design features, should be determined by conducting pre-disturbance surveys for the species and
17 its habitat on the SEZ.

18 19 20 **Parish Alkali Grass**

21
22 The Parish alkali grass is not known to occur in the affected area of the Bullard Wash
23 SEZ; however, approximately 15 acres (<0.1 km²) of potentially suitable desert wash or riparian
24 habitat on the SEZ may be directly affected by construction and operations of solar energy
25 development on the SEZ (Table 8.2.12.1-1). This direct effects area represents about less than
26 0.1% of available suitable habitat in the region. About 145 acres (0.6 km²) of potentially suitable
27 desert wash or riparian habitat occurs in the area of potential indirect effects; this area represents
28 about 0.7% of the available suitable habitat in the region (Table 8.2.12.1-1).

29
30 The overall impact on the Parish alkali grass from construction, operation, and
31 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
32 considered small because less than 1% of potentially suitable habitat for this species occurs in
33 the area of direct effects. The implementation of programmatic design features is expected to be
34 sufficient to reduce indirect impacts to negligible levels.

35
36 Avoiding or minimizing disturbance to desert riparian habitats in the area of direct effects
37 could reduce direct impacts on this species to negligible levels. Alternatively, impacts could be
38 reduced with the implementation of programmatic design features and the mitigation options
39 described previously for the Bigelow onion could reduce direct impacts on this species to
40 negligible levels. The need for mitigation, other than programmatic design features, should be
41 determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

1 **Straw-Top Cholla**

2
3 The straw-top cholla is not known to occur in the affected area of the Bullard Wash
4 SEZ; however, approximately 15 acres (<0.1 km²) of potentially suitable desert wash or
5 riparian habitat on the SEZ may be directly affected by construction and operations of solar
6 energy development on the SEZ (Table 8.2.12.1-1). This direct effects area represents about
7 less than 0.1 % of available suitable habitat in the region. About 145 acres (0.6 km²) of
8 potentially suitable desert wash or riparian habitat occurs in the area of potential indirect
9 effects; this area represents about 0.7% of the available suitable habitat in the region
10 (Table 8.2.12.1-1).

11
12 The overall impact on the straw-top cholla from construction, operation, and
13 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
14 considered small because less than 1% of potentially suitable habitat for this species occurs in
15 the area of direct effects. The implementation of programmatic design features is expected to
16 be sufficient to reduce indirect impacts to negligible levels.

17
18 Avoiding or minimizing disturbance to desert riparian habitats in the area of direct effects
19 could reduce direct impacts on this species to negligible levels. Alternatively, impacts could be
20 reduced with the implementation of programmatic design features, and the mitigation options
21 described previously for the Bigelow onion could reduce direct impacts on this species to
22 negligible levels. The need for mitigation, other than programmatic design features, should be
23 determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

24
25
26 **Arizona Skink**

27
28 The Arizona skink is not known to occur in the affected area of the Bullard Wash
29 SEZ, and suitable habitat for this species is not expected to occur in the area of direct effects.
30 However, approximately 114 acres (0.5 km²) of potentially suitable habitat occurs in the area
31 of indirect effects; this area represents less than 0.1% of the potentially suitable habitat in the
32 SEZ region (Table 8.2.12.1-1).

33
34 The overall impact on the Arizona skink from construction, operation, and
35 decommissioning of utility-scale solar energy facilities within the Bullard Wash SEZ is
36 considered small because suitable habitat for this species does not occur anywhere in the area
37 of direct effects and only indirect effects are possible. The implementation of programmatic
38 design features is expected to be sufficient to reduce indirect impacts on this species to negligible
39 levels. No species-specific mitigation for this species is necessary because potentially suitable
40 habitat does not occur within the area of direct effects.

41
42
43 **8.2.12.2.6 Impacts on Rare Species**

44
45 There are 34 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern
46 by the USFWS) that may be affected by solar energy development on the Bullard Wash SEZ

1 (Table 8.2.12.1-1). Impacts on 10 rare species have not been discussed previously. These include
2 the following: (1) plants—arid tansy-aster and Davidson sage; (2) invertebrate—Maricopa tiger
3 beetle; (3) amphibian—Arizona toad; (4) reptiles—Arizona night lizard, Gila monster, and
4 Mojave shovel-nosed snake; (5) bird—long-eared owl; and (6) mammals—cave myotis and
5 Yuma myotis. Impacts on these species are presented in Table 8.2.12.1-1.
6
7

8 **8.2.12.3 SEZ-Specific Design Features and Design Feature Effectiveness** 9

10 The implementation of required programmatic design features described in Appendix A,
11 Section A.2.2, would greatly reduce or eliminate the potential for effects of utility-scale solar
12 energy development on special status species. While some SEZ-specific design features are best
13 established when project details are being considered, some design features can be identified at
14 this time, including the following:
15

- 16 • Pre-disturbance surveys should be conducted within the SEZ and transmission
17 corridor to determine the presence and abundance of special status species,
18 including those identified in Table 8.2.12.1-1; disturbance to occupied habitats
19 for these species should be avoided or minimized to the extent practicable. If
20 avoiding or minimizing impacts to occupied habitats is not possible,
21 translocation of individuals from areas of direct effects or compensatory
22 mitigation of direct effects on occupied habitats could reduce impacts. A
23 comprehensive mitigation strategy for special status species that uses one
24 or more of these options to offset the impacts of development should be
25 developed in coordination with the appropriate federal and state agencies.
26
- 27 • Consultation with the USFWS and AZGFD should be conducted to address
28 the potential for impacts on the following species currently listed as
29 threatened or endangered under the ESA: Arizona cliff rose, desert pupfish,
30 Gila topminnow, Sonoran bald eagle, and southwestern willow flycatcher.
31 Consultation would identify an appropriate survey protocol, avoidance
32 and minimization measures, and, if appropriate, reasonable and prudent
33 alternatives, reasonable and prudent measures, and terms and conditions
34 for incidental take statements (if necessary).
35
- 36 • Coordination with the USFWS and AZGFD should be conducted to address
37 the potential for impacts on the Sonoran population of the desert tortoise, a
38 species under review for listing under the ESA. Coordination would identify
39 an appropriate survey protocol and mitigation requirements, which may
40 include avoidance, minimization, translocation, or compensation.
41
- 42 • Avoiding or minimizing disturbance to desert wash or riparian habitat within
43 the area of direct effects could reduce or eliminate impacts on the following
44 special status species: Aravaipa wood fern, arid tansy-aster, Arizona giant
45 sedge, golden barrel cactus, Hohokam agave, Parish alkali grass, Parish's
46 phacelia, Pima Indian mallow, straw-top cholla, Maricopa tiger beetle,

1 Arizona toad, lowland leopard frog, southwestern willow flycatcher, western
2 red bat, and western yellow bat.

- 3
- 4 • Avoidance or minimization of groundwater withdrawals to serve solar energy
5 development on the SEZ could reduce or eliminate impacts on the following
6 special status species with habitats dependent upon groundwater discharge
7 in the SEZ region: desert pupfish, Gila topminnow, snowy egret, and
8 southwestern willow flycatcher. In particular, aquatic and riparian habitat
9 associated with the Tres Alamos and Yerba Mansa springs should be avoided.
- 10
- 11 • Harassment or disturbance of special status species and their habitats in the
12 affected area should be mitigated. This can be accomplished by identifying
13 any additional sensitive areas and implementing necessary protection
14 measures based upon consultation with the USFWS and AZGFD.
- 15

16 If these SEZ-specific design features are implemented in addition to required
17 programmatic design features, impacts on the special status and rare species could be reduced.

18

1 **8.2.13 Air Quality and Climate**

2
3
4 **8.2.13.1 Affected Environment**

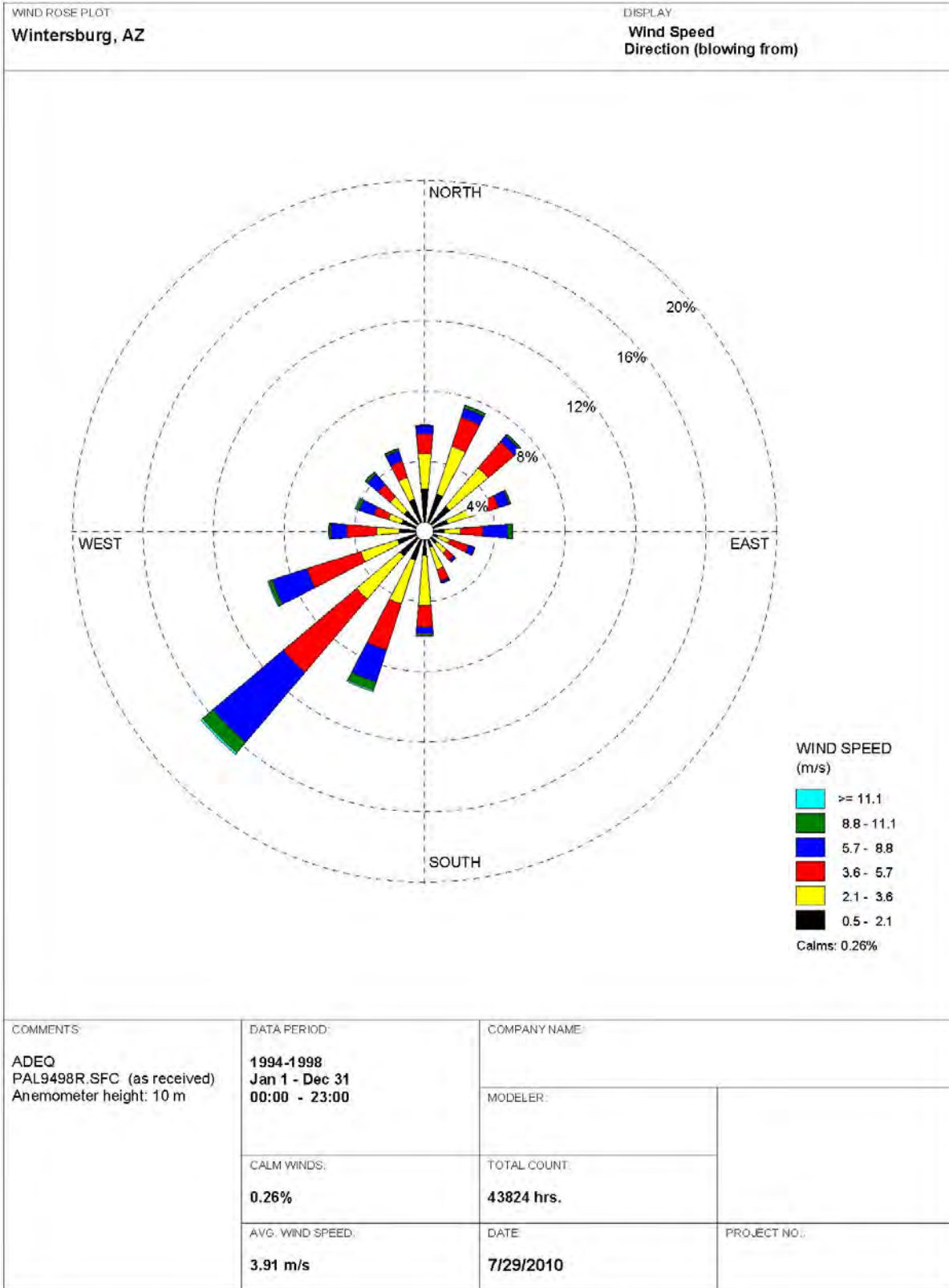
5
6
7 **8.2.13.1.1 Climate**

8
9 The proposed Bullard Wash SEZ is located in near central Arizona, in the southwest
10 corner of Yavapai County. The topography of the county has a drastic transition from the lower
11 Sonoran Desert to the south to higher elevations to the north and the east. The SEZ has an
12 average elevation of 2,440 ft (740 m) and is located on the valley floor near the edge of
13 neighboring mountain ranges, which are developed in the northeast–southwest direction. The
14 SEZ is located in the northern portion of the Sonoran Desert, which covers the southwest of
15 Arizona, southern California, and northwestern Mexican states. The area experiences a desert-
16 like arid climate, characterized by hot summers, mild winters, light precipitation, a high rate
17 of evaporation, low relative humidity, abundant sunshine, and large temperature ranges
18 (NCDC 2010a). Meteorological data collected at Wintersburg, about 50 mi (80 km) south–
19 southeast of the Bullard Wash SEZ boundary, and at Aguila, about 10 mi (16 km) south, are
20 summarized below.

21
22 A wind rose from Wintersburg, for the 5-year period 1994 to 1998, taken at a level of
23 33 ft (10 m), is presented in Figure 8.2.13.1-1 (Mao 2010).⁶ During this period, the annual
24 average wind speed at the airport was about 8.7 mph (3.9 m/s); the prevailing wind direction
25 was from the southwest (about 16.6% of the time) and secondarily from the south–southwest
26 (about 9.6% of the time) and the west–southwest (about 9.3% of the time). Winds blew more
27 frequently from the southwest from March to October, and from the north–northeast from
28 November to February. Wind speeds categorized as calm (<1.1 mph [0.5 m/s]) occurred
29 infrequently (about 0.3% of the time). Average wind speeds by season were the highest in
30 summer at 9.9 mph (4.4 m/s); lower in spring and fall at 9.7 mph (4.3 m/s) and 7.9 mph
31 (3.5 m/s), respectively; and lowest in winter at 7.4 mph (3.3 m/s).

32
33 In Arizona, topography plays a large role in determining the temperature of any specific
34 location. For the 1924 to 2010 period, the annual average temperature at Aguila was 65.6°F
35 (18.7°C) (WRCC 2010). January was the coldest month, with an average minimum temperature
36 of 33.2°F (0.7°C), and July was the warmest month, with an average maximum of 102.4°F
37 (39.1°C). In summer, daytime maximum temperatures more than 100°F (37.8°C) are common,
38 and minimums are in the 60s. The minimum temperatures recorded were below freezing ($\leq 32^\circ\text{F}$
39 [0°C]) during the colder months (about 15 days in December and January), but subzero
40 temperatures were never recorded. During the same period, the highest temperature,

⁶ No meteorological stations representative of the proposed Bullard Wash SEZ exist near the SEZ. Wintersburg is chosen to be representative of the SEZ, although it is located rather far from the Bullard Wash SEZ, considering that the northeast–southwest orientation of the valley and mountain ranges near the SEZ match the prevailing wind direction at Wintersburg.



1

2

FIGURE 8.2.13.1-1 Wind Rose at 33 ft (10 m) at Wintersburg, Arizona, 1994 to 1998

3

(Source: Mao 2010)

1 117°F (47.2°C), was reached in July 1958, and the lowest, 11°F (−11.7°C), in January 1950. In
2 a typical year, about 144 days had a maximum temperature of 90°F (32.2°C) or higher, while
3 about 49 days had minimum temperatures at or below freezing.
4

5 Throughout Arizona, precipitation patterns largely depend on elevation and the season of
6 the year. In Arizona, rain comes mostly in two distinct seasons (winter and summer monsoon
7 season) (NCDC 2010a). For the 1924 to 2010 period, annual precipitation at Aguila averaged
8 about 8.48 in. (21.5 cm) (WRCC 2010). On average, there are 28 days annually with measurable
9 precipitation (0.01 in. [0.025 cm] or higher). Seasonally, precipitation is the highest in winter
10 followed by summer, and the lowest in spring. Snowfall at Aguila is uncommon and limited to
11 winter months. The annual average snowfall at Aguila was about 0.4 in. (1.0 cm), and the highest
12 monthly snowfall recorded was 6.0 in. (15.2 cm) in December 1967.
13

14 The proposed Bullard Wash SEZ is far from major water bodies (more than 180 mi
15 [290 km] to the Gulf of California). Severe weather events, such as floods, hails, high winds,
16 thunderstorm winds, have been reported in Yavapai County, which encompasses the Bullard
17 Wash SEZ (NCDC 2010b). However, most events were reported at higher elevations, not near
18 the SEZ.
19

20 In Arizona, flood conditions occur infrequently, but heavy thunderstorms during summer
21 thunderstorm season cause floods at times that do considerable local damage. Since 1993,
22 90 floods (two-thirds of which were flash floods) were reported in Yavapai County, most of
23 which occurred in towns at higher elevations, far from the SEZ. These floods caused one death
24 and some property damage.
25

26 In Yavapai County, 129 hail events were reported, mostly from July to September since
27 1962, which caused one death, two injuries, and considerable property damage. Hail size of
28 4.5 in. (11.4 cm) in diameter was reported in 1995. Since 1994, 19 high wind events with the
29 highest wind speed of 89 mph (40 m/s) were reported, which occurred any month of the year.
30 Since 1961, 78 thunderstorm winds were reported, and those up to a maximum wind speed of
31 115 mph (51 m/s) occurred mostly during summer months and caused two injuries and some
32 property damage (NCDC 2010b).
33

34 One dust storm event was reported in Yavapai County in 2009 (NCDC 2010b). However,
35 the ground surface of the SEZ is covered predominantly with sandy loams (with some gravelly
36 sandy loams), which have moderate dust storm potential. On occasion, high winds accompanied
37 by thunderstorms and dry soil conditions could result in blowing dust in Yavapai County. Dust
38 storms can deteriorate air quality and visibility and have adverse health effects.
39

40 Hurricanes and tropical storms formed off the coast of Central America and Mexico
41 weaken over the cold waters off the California coast. Accordingly, hurricanes rarely hit Arizona
42 through California. Historically, two tropical storm/depressions from the Gulf of California
43 passed within 100 mi (160 km) of the proposed Bullard Wash SEZ (CSC 2010). In the period
44 from 1950 to April 2010, a total of 22 tornadoes (0.4 per year each) were reported in Yavapai
45 County (NCDC 2010b). Most tornadoes occurring in Yavapai County were relatively weak

(i.e., 4 were F [uncategorized⁷], 14 were F0, 3 were F1, and one was F3 on the Fujita tornado scale), and all of these tornadoes occurred far from the SEZ. None of these tornadoes caused deaths or injuries, but some of them caused property and crop damages.

8.2.13.1.2 Existing Air Emissions

Yavapai County has limited industrial emission sources over the county, and their emissions are relatively small with a few exceptions. No emission sources are located around the proposed Bullard Wash SEZ. Several major roads exist in Yavapai County, such as I-17 and I-40, U.S. 93, and several state routes. Thus, onroad mobile source emissions are substantial compared with other sources in Yavapai County. Data on annual emissions of criteria pollutants and VOCs in Yavapai County are presented in Table 8.2.13.1-1 (WRAP 2009). Emission data are classified into six source categories: point, area (including fugitive dust), onroad mobile, nonroad mobile, biogenic, and fire (wildfires, prescribed fires, agricultural fires, structural fires). In 2002, point sources were major contributors to total SO₂ emissions (about 62%) and secondary contributors to NO_x emissions (about 18%). Onroad sources were major contributors to NO_x and CO emissions (about 53 and 65%, respectively). Biogenic sources (i.e., vegetation—including trees, plants, and crops—and soils) that release naturally occurring emissions contributed secondarily to CO emissions (about 18%), and accounted for most of the VOC emissions (about 93%). Area sources accounted for about 90% of PM₁₀ and 84% of PM_{2.5}. In Yavapai County, nonroad sources were secondary contributors to SO₂ and NO_x emissions, while fire sources were minor contributors to criteria pollutants and VOCs.

In 2010, Arizona is projected to produce about 116.6 MMt of gross⁸ carbon dioxide equivalent (CO₂e)⁹ emissions, which is about 1.6% of total U.S. GHG emissions in 2007 (Bailie et al. 2005). Gross GHG emissions in Arizona increased by about 77% from 1990 to 2010 because of Arizona’s rapid population growth and attendant economic growth, compared to

TABLE 8.2.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Yavapai County, Arizona, Encompassing the Proposed Bullard Wash SEZ, 2002^a

Pollutant	Emissions (tons/yr)
SO ₂	1,579
NO _x	19,249
CO	140,829
VOCs	184,328
PM ₁₀	16,808
PM _{2.5}	4,322

^a Includes point, area (including fugitive dust), onroad and nonroad mobile, biogenic, and fire emissions.

^b Notation: CO = carbon monoxide; NO_x = nitrogen oxides; PM_{2.5} = particulate matter with a diameter of ≤2.5 μm; PM₁₀ = particulate matter with a diameter of ≤10 μm; SO₂ = sulfur dioxide; VOC = volatile organic compounds.

Source: WRAP (2009).

⁷ Not categorized by the Fujita tornado scale because damage level was not reported.

⁸ Excluding GHG emissions removed as a result of forestry and other land uses and excluding GHG emissions associated with exported electricity.

⁹ A measure used to compare the emissions from various GHGs on the basis of their global warming potential, defined as the cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas, CO₂. The CO₂e for a gas is derived by multiplying the mass of the gas by the associated global warming potential.

1 16% growth in U.S. GHG emissions during the 1990 to 2005 period. In 2005, electricity use
2 (about 40.0%) and transportation (about 38.9%) were the primary contributors to gross GHG
3 emission sources in Arizona. Fuel use in the residential, commercial, and industrial (RCI) sectors
4 combined accounted for about 15.4% of total state emissions. Arizona's *net* emissions were
5 about 109.9 MMt CO₂e, considering carbon sinks from forestry activities and agricultural soils
6 throughout the state. The EPA (2009a) also estimated 2005 emissions in Arizona. Its estimate
7 of CO₂ emissions from fossil fuel combustion was 97.2 MMt, which was comparable to the
8 state's estimate. Electric power generation and transportation accounted for about 51.8% and
9 38.8% of the CO₂ emissions total, respectively, while the RCI sectors accounted for the
10 remainder (about 9.4%).
11
12

13 **8.2.13.1.3 Air Quality** 14

15 The State of Arizona has adopted the NAAQS for six criteria pollutants: SO₂, NO₂, CO,
16 O₃, PM₁₀ and PM_{2.5}, and Pb (ADEQ 2009; EPA 2010a). Table 8.2.13.1-2 gives the NAAQS for
17 criteria pollutants.
18

19 Yavapai County is located administratively within the Northern Arizona Intrastate AQCR
20 (40 CFR 81.270), along with Apache, Coconino, and Navajo Counties. Currently, the area
21 surrounding the proposed SEZ is designated by the U.S. EPA as being in unclassifiable/
22 attainment of NAAQS for all criteria pollutants (40 CFR 81.303).
23

24 Because of relatively low population density in Yavapai County, it has no significant
25 industrial emission sources of its own, and mobile emissions along major highways account for
26 considerable NO_x and CO emissions. Accordingly, ambient air quality in Yavapai County is
27 relatively good, except for O₃ and possibly PM. There are three ambient air-monitoring stations
28 in Yavapai County: Hillside, located about 22 mi (35 km) north-northeast of the SEZ; Prescott,
29 about 47 mi (76 km) northeast; and Prescott Valley, about 55 mi (88 km) northeast. O₃
30 concentrations were monitored at Hillside until 2005 and at Prescott in 2008. PM₁₀ and PM_{2.5}
31 concentrations have been collected at Prescott Valley but are judged as not representative of the
32 SEZ considering the difference in land use. NO₂ monitoring data at Alamo Lake State Park in
33 La Paz County, which is located about 22 mi (35 km) west-northwest of the SEZ, and ozone
34 monitoring data at Hillside are presented. To characterize ambient air quality for other criteria
35 pollutants around the SEZ, the three closest monitoring stations (all in Maricopa County) were
36 chosen. CO and PM₁₀ concentrations from Buckeye, which is located about 58 mi (93 km)
37 south-southeast of the SEZ, are presented. For SO₂ and PM_{2.5}, the highest concentrations at
38 two monitoring stations in the Phoenix area, which are located about 71 mi (114 km) and more
39 southeast of the SEZ, are presented. No Pb measurements have been made in the state of Arizona
40 because of low Pb concentration levels after the phaseout of leaded gasoline. The highest
41 background concentrations of criteria pollutants at these stations for the period 2004 to 2008 are
42 presented in Table 8.2.13.1-2 (EPA 2010b). The highest concentration levels were lower than
43 their respective standards (up to 10%), except for O₃, PM₁₀, and PM_{2.5}, which approached or
44 exceeded their respective NAAQS. These criteria pollutants are of regional concern in the area,
45 due to high temperatures, abundant sunshine, and windblown dust from occasional high winds
46 and dry soil conditions.

TABLE 8.2.13.1-2 NAAQS and Background Concentration Levels Representative of the Proposed Bullard Wash SEZ in Yavapai County, Arizona, 2004 to 2008

Pollutant ^a	Averaging Time	NAAQS	Background Concentration Level	
			Concentration ^{b,c}	Measurement Location, Year
SO ₂	1-hour	75 ppb ^d	– ^e	–
	3-hour	0.5 ppm	0.013 ppm (2.6%)	Phoenix, Maricopa County, 2007
	24-hour	0.14 ppm	0.008 ppm (5.7%)	Phoenix, Maricopa County, 2004
	Annual	0.030 ppm	0.003 ppm (10%)	Phoenix, Maricopa County, 2004
NO ₂	1-hour	100 ppb ^f	–	–
	Annual	0.053 ppm	0.003 ppm (5.7%)	Alamo Lake State Park, La Paz County, 2006
CO	1-hour	35 ppm	1.6 ppm (4.6%)	Buckeye, Maricopa County, 2007
	8-hour	9 ppm	0.9 ppm (10%)	Buckeye, Maricopa County, 2005
O ₃	1-hour	0.12 ppm ^g	0.085 ppm (71%)	Hillside, Yavapai County, 2004
	8-hour	0.075 ppm	0.077 ppm (103%)	Hillside, Yavapai County, 2004
PM ₁₀	24-hour	150 µg/m ³	204 µg/m ³ (136%)	Buckeye, Maricopa County, 2008
	Annual	50 µg/m ³ ^h	53 µg/m ³ (106%)	Buckeye, Maricopa County, 2007
PM _{2.5}	24-hour	35 µg/m ³	42.3 µg/m ³ (121%)	Phoenix, Maricopa County, 2005
	Annual	15.0 µg/m ³	13.5 µg/m ³ (90%)	Phoenix, Maricopa County, 2006
Pb	Calendar quarter	1.5 µg/m ³	–	–
	Rolling 3-month	0.15 µg/m ³ ⁱ	–	–

^a Notation: CO = carbon monoxide; NO₂ = nitrogen dioxide; O₃ = ozone; Pb = lead; PM_{2.5} = particulate matter with a diameter of ≤2.5 µm; PM₁₀ = particulate matter with a diameter of ≤10 µm; SO₂ = sulfur dioxide.

^b Monitored concentrations are the second-highest for all averaging times less than or equal to 24-hour averages, except fourth-highest daily maximum for 8-hour O₃ and the 98th percentile for 24-hour PM_{2.5}; and arithmetic mean for annual SO₂, NO₂, PM₁₀, and PM_{2.5}.

^c Values in parentheses are background concentration levels as a percentage of NAAQS. Calculation of 1-hour SO₂ and NO₂ to NAAQS was not made, because no measurement data based on new NAAQS are available.

^d Effective August 23, 2010.

^e A dash indicates not applicable or not available.

^f Effective April 12, 2010.

^g The EPA revoked the 1-hour O₃ standard in all areas, although some areas have continuing obligations under that standard (“anti-backsliding”).

^h Effective December 18, 2006, the EPA revoked the annual PM₁₀ standard of 50 µg/m³ but annual PM₁₀ concentrations are presented for comparison purposes.

ⁱ Effective January 12, 2009.

Sources: ADEQ (2009); EPA (2010a,b).

1 The PSD regulations (see 40 CFR 52.21), which are designed to limit the growth of air
2 pollution in clean areas, apply to a major new source or modification of an existing major source
3 within an attainment or unclassified area (see Section 4.11.2.3). As a matter of policy, the EPA
4 recommends that the permitting authority notify the Federal Land Managers when a proposed
5 PSD source would locate within 62 mi (100 km) of a sensitive Class I area. There are several
6 Class I areas around the Bullard Wash SEZ, none of which are situated within the 62-mi
7 (100-km) distance in Arizona and California. The nearest Class I area is Pine Mountain WA
8 (40 CFR 81.403), about 72 mi (116 km) east of the Bullard Wash SEZ. This Class I area is not
9 located downwind of prevailing winds at the Bullard Wash SEZ (Figure 8.2.13.1-1). The next
10 nearest Class I areas include Sycamore Canyon WA, Mazatzal WA, and Superstition WA,
11 which are located about 76 mi (122 km) northeast, 79 mi (127 km) east, and 104 mi (167 km)
12 east-southeast of the SEZ, respectively.

13 14 15 **8.2.13.2 Impacts**

16
17 Potential impacts on ambient air quality associated with a solar project would be of
18 most concern during the construction phase. Impacts on ambient air quality from fugitive dust
19 emissions resulting from soil disturbances are anticipated, but they would be of short duration.
20 During the operations phase, only a few sources with generally low-level emissions would exist
21 for any of the four types of solar technologies evaluated. A solar facility would either not burn
22 fossil fuels or burn only small amounts during operation. (For facilities using HTFs, fuel could
23 be used to maintain the temperature of the HTFs for more efficient daily start-up.) Conversely,
24 solar facilities would displace air emissions that would otherwise be released from fossil fuel
25 power plants.

26
27 Air quality impacts shared by all solar technologies are discussed in detail in
28 Section 5.11.1, and technology-specific impacts are discussed in Section 5.11.2. Impacts specific
29 to the proposed Bullard Wash SEZ are presented in the following sections. Any such impacts
30 would be minimized through the implementation of required programmatic design features
31 described in Appendix A, Section A.2.2, and through the application of any additional
32 mitigation. Section 8.2.13.3, below, identifies SEZ-specific design features of particular
33 relevance to the Bullard Wash SEZ.

34 35 36 **8.2.13.2.1 Construction**

37
38 The Bullard Wash SEZ has a relatively flat terrain; thus only a minimum number of site
39 preparation activities, perhaps with no large-scale earthmoving operations, would be required.
40 However, fugitive dust emissions from soil disturbances during the entire construction phase
41 would be a major concern because of the large areas that would be disturbed in a region that
42 experiences windblown dust problems. Fugitive dusts, which are released near ground level,
43 typically have more localized impacts than similar emissions from an elevated stack, with
44 additional plume rise induced by buoyancy and momentum effects.

1 **Methods and Assumptions**

2
3 Air quality modeling for PM₁₀ and PM_{2.5} emissions associated with construction
4 activities was performed by using the EPA-recommended AERMOD model (EPA 2009b).
5 Details for emissions estimation, the description of AERMOD, input data processing procedures,
6 and modeling assumption are described in Appendix M, Section M.13. Estimated air
7 concentrations were compared with the applicable NAAQS levels at the site boundaries and
8 nearby communities and with PSD increment levels at nearby Class I areas.¹⁰ However, no
9 receptors were modeled for PSD analysis at the nearest Class I area, Pine Mountain WA, because
10 it is about 72 mi (116 km) from the SEZ, which is farther than the maximum modeling distance
11 of 31 mi (50 km) for the AERMOD. Rather, several regularly spaced receptors in the direction of
12 the Pine Mountain WA were selected as surrogates for the PSD analysis. For the Bullard Wash
13 SEZ, the modeling was conducted based on the following assumptions and input:

- 14 • Uniformly distributed emissions of 3,000 acres (12.1 km²) in the southern
15 portion of the SEZ, close to the nearest residences and the town of Aguila;
- 16 • Surface hourly meteorological data from Phoenix Sky Harbor International
17 Airport, upper air sounding data from Tucson, and on-site data from
18 Wintersburg for the 1994 to 1998 period (Mao 2010); and
- 19 • A regularly spaced receptor grid over a modeling domain of 62 × 62 mi
20 (100 km × 100 km) centered on the proposed SEZ, and additional discrete
21 receptors at the SEZ boundaries.

22 **Results**

23
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28
29 Table 8.2.13.2-1 summarizes the modeling results for concentration increments and total
30 concentrations (modeled plus background concentrations) for both PM₁₀ and PM_{2.5} that would
31 result from construction-related fugitive emissions. Maximum 24-hour PM₁₀ concentration
32 increments modeled to occur at the SEZ boundary would be an estimated 845 µg/m³, which
33 far exceeds the relevant standard level of 150 µg/m³. Total 24-hour PM₁₀ concentrations of
34 1,049 µg/m³ would also exceed the standard level at the SEZ boundary. However, high PM₁₀
35 concentrations would be limited to the immediate areas surrounding the SEZ boundary and
36 would decrease quickly with distance. Predicted maximum 24-hour PM₁₀ concentration
37 increments would be about 45 µg/m³ at the nearest residences, which are about 5.6 mi (9 km)
38 south-southwest of the SEZ, about 30 to 40 µg/m³ at Aguila, and about 15 µg/m³ at
39 Wickenburg. Annual average modeled concentration increments and total concentrations
40 (increment plus background) for PM₁₀ at the SEZ boundary would be about 155 µg/m³ and

¹⁰ To provide a quantitative assessment, the modeled air impacts of construction were compared to the NAAQS levels and the PSD Class I increment levels. Although the Clean Air Act exempts construction activities from PSD requirements, a comparison with the Class I increment levels was used to quantify potential impacts. Only monitored data can be used to determine the attainment status. Modeled data are used to assess potential problems and as a consideration in the permitting process.

TABLE 8.2.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Bullard Wash SEZ

Pollutant ^a	Averaging Time	Rank ^b	Concentration ($\mu\text{g}/\text{m}^3$)				Percentage of NAAQS	
			Maximum Increment ^b	Background ^c	Total	NAAQS	Increment	Total
PM ₁₀	24 hours	H6H	845	204	1,049	150	563	699
	Annual	– ^d	155	53.0	208	50	310	416
PM _{2.5}	24 hours	H8H	56.9	42.3	99.2	35	162	283
	Annual	–	15.5	13.5	29.0	15.0	103	193

^a PM_{2.5} = particulate matter with a diameter of $\leq 2.5 \mu\text{m}$; PM₁₀ = particulate matter with a diameter of $\leq 10 \mu\text{m}$.

^b Concentrations for attainment demonstration are presented. H6H = highest of the sixth-highest concentrations at each receptor over the 5-year period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-year period. For the annual average, multiyear averages of annual means over the 5-year period are presented. Maximum concentrations are predicted to occur at the site boundaries.

^c See Table 8.2.13.1-2.

^d A dash indicates not applicable.

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208 $\mu\text{g}/\text{m}^3$, respectively, which are higher than the NAAQS level of 50 $\mu\text{g}/\text{m}^3$, which was revoked by EPA in December 2006. Annual PM₁₀ increments would be much lower, about 3 $\mu\text{g}/\text{m}^3$ at the nearest receptors, and about 1 to 2 $\mu\text{g}/\text{m}^3$ at Aguila, and about 0.2 $\mu\text{g}/\text{m}^3$ at Wickenburg.

Total 24-hour PM_{2.5} concentrations would be 99.2 $\mu\text{g}/\text{m}^3$ at the SEZ boundary, which is higher than the NAAQS level of 35 $\mu\text{g}/\text{m}^3$; modeled increments contribute slightly more than background concentration to this total. The total annual average PM_{2.5} concentration would be 29.0 $\mu\text{g}/\text{m}^3$, which is above the NAAQS level of 15.0 $\mu\text{g}/\text{m}^3$. At the nearest residences, predicted maximum 24-hour and annual PM_{2.5} concentration increments would be about of about 2.5 and 0.3 $\mu\text{g}/\text{m}^3$, respectively.

Predicted 24-hour and annual PM₁₀ concentration increments at the surrogate receptors for the nearest Class I Area—Pine Mountain WA—would be about 8.4 and 0.14 $\mu\text{g}/\text{m}^3$, or 105 and 3.5% of the PSD increments for the Class I area, respectively. These surrogate receptors are more than 41 mi (66 km) from the Pine Mountain WA, and thus predicted concentrations in Pine Mountain WA would be much lower than the above values (about 45% of the PSD increments for 24-hour PM₁₀), considering the same decay ratio with distance.

In conclusion, predicted 24-hour and annual PM₁₀ and PM_{2.5} concentration levels could exceed the NAAQS levels at the SEZ boundaries and in the immediate surrounding areas during the construction of solar facilities. To reduce potential impacts on ambient air quality and in

1 compliance with programmatic design features, aggressive dust control measures would be used.
2 Potential air quality impacts on nearby communities would be much lower. Modeling indicates
3 that emissions from construction activities are not anticipated to exceed Class I PSD PM₁₀
4 increments at the nearest federal Class I area (Pine Mountain WA). Construction activities are
5 not subject to the PSD program, and the comparison provides only a screen for gauging the size
6 of the impact. Accordingly, it is anticipated that impacts of construction activities on ambient air
7 quality would be moderate and temporary.
8

9 Construction emissions from the engine exhaust from heavy equipment and vehicles have
10 the potential to affect AQRVs (e.g., visibility and acid deposition) at the nearby federal Class I
11 area. However, SO_x emissions from engine exhaust would be very low, because programmatic
12 design features would require ultra-low-sulfur fuel with a sulfur content of 15 ppm. NO_x
13 emissions from engine exhaust would be primary contributors to potential impacts on AQRVs.
14 Construction-related emissions are temporary in nature and thus would cause some unavoidable
15 but short-term impacts.
16

17 Transmission lines within a designated ROW would be constructed to connect to the
18 nearest regional grid. A regional 500-kV transmission line is located about 5 mi (8 km) from the
19 proposed Bullard Wash SEZ; thus construction of a transmission line over this distance would
20 likely be needed. Construction activities would result in fugitive dust emissions from soil
21 disturbance and engine exhaust emissions from heavy equipment and vehicles. Construction
22 time for the transmission line could be about 6 months. However, the site of construction along
23 the transmission line ROW would move continuously, thus no particular area would be exposed
24 to air emissions for a prolonged period. Therefore, potential air quality impacts on nearby
25 residences along the transmission line ROW, if any, would be minor and temporary in nature.
26
27

28 **8.2.13.2.2 Operations**

29

30 Emission sources associated with the operation of a solar facility would include auxiliary
31 boilers; vehicle (commuter, visitor, support, and delivery) traffic; maintenance (e.g., mirror
32 cleaning and repair and replacement of damaged mirrors); and drift from cooling towers for the
33 parabolic trough or power tower technology if wet cooling were implemented (drift comprises
34 low-level PM emissions). Some of these sources may need to comply with emissions standards
35 including, but not limited to, the New Source Performance Standards (NSPS) for boilers
36 (40 CFR Part 60), the NSPS for stationary diesels (40 CFR 60 Subpart IIII), federal requirements
37 for nonroad diesels (40 CFR Part 89), and the NESHAP for stationary reciprocating engines
38 (40 CFR 63 Subpart ZZZZ). In addition, given the typically small emissions, it is unlikely that
39 PSD requirements would apply to typical solar energy facilities.
40

41 Table 8.2.13.2-2 presents potential air emissions displaced by solar project development
42 at the proposed Bullard Wash SEZ. Total power generation capacity ranging from 643 to
43 1,158 MW is estimated for the Bullard Wash SEZ for various solar technologies
44 (see Section 8.2.2). The estimated amount of emissions avoided for the solar technologies
45 evaluated depends only on the megawatts of conventional fossil fuel-generated power displaced,
46 because a composite emission factor per megawatt-hour of power by conventional technologies

TABLE 8.2.13.2-2 Annual Emissions from Combustion-Related Power Generation Avoided by Full Solar Development of the Proposed Bullard Wash SEZ

Area Size (acres)	Capacity (MW) ^a	Power Generation (GWh/yr) ^b	Emissions Displaced (tons/yr; 10 ³ tons/yr for CO ₂) ^c			
			SO ₂	NO _x	Hg	CO ₂
7,239	643–1,158	1,127–2,029	868–1,563	1,337–2,406	0.012–0.022	958–1,725
Percentage of total emissions from electric power systems in Arizona ^d			1.6–2.9%	1.6–2.9%	1.6–2.9%	1.6–2.9%
Percentage of total emissions from all source categories in Arizona ^e			0.78–1.4%	0.37–0.66%	– ^f	0.89–1.6%
Percentage of total emissions from electric power systems in the six-state study area ^d			0.35–0.62%	0.36–0.65%	0.42–0.75%	0.37–0.66%
Percentage of total emissions from all source categories in the six-state study area ^e			0.18–0.33%	0.05–0.09%	–	0.11–0.21%

^a It is assumed that the SEZ would eventually have development on 80% of the lands and that a range of 5 acres (0.020 km²) per MW (for parabolic trough technology) to 9 acres (0.036 km²) per MW (power tower, dish engine, and photovoltaic technologies) would be required.

^b A capacity factor of 20% was assumed.

^c Composite combustion-related emission factors for SO₂, NO_x, Hg, and CO₂ of 1.54, 2.37, 2.2 × 10⁻⁵, and 1,700 lb/MWh, respectively, were used for the state of Arizona.

^d Emission data for all air pollutants are for 2005.

^e Emission data for SO₂ and NO_x are for 2002, while those for CO₂ are for 2005.

^f A dash indicates not estimated.

Sources: EPA (2009a,c); WRAP (2009).

1
2
3 is assumed (EPA 2009c). If the Bullard Wash SEZ were fully developed, it is expected that
4 emissions avoided would be somewhat considerable. Development of solar power in the SEZ
5 would result in avoided air emissions ranging from 1.6 to 2.9% of total emissions of SO₂, NO_x,
6 Hg, and CO₂ from electric power systems in the state of Arizona (EPA 2009c). Avoided
7 emissions would be up to 0.75% of total emissions from electric power systems in the six-state
8 study area. When compared with all source categories, power production from the same solar
9 facilities would displace up to 1.4% of SO₂, 0.66% of NO_x, and 1.6% of CO₂ emissions in the
10 state of Arizona (EPA 2009a; WRAP 2009). These emissions would be up to 0.33% of total
11 emissions from all source categories in the six-state study area. Power generation from fossil
12 fuel-fired power plants accounts for about 68% of the total electric power generated in Arizona
13 for which contribution of coal combustion is about 40%, followed by natural gas combustion
14 of about 28%. Thus, solar facilities to be built in the Bullard Wash SEZ could reduce fuel-

1 combustion-related emissions in Arizona to some extent, but relatively less so than those built in
2 other states with higher fossil use rates.

3
4 As discussed in Section 5.11.1.5, the operation of associated transmission lines would
5 generate some air pollutants from activities such as periodic site inspections and maintenance.
6 However, these activities would occur infrequently, and the amount of emissions would be
7 small. In addition, transmission lines could produce minute amounts of O₃ and its precursor
8 NO_x associated with corona discharge (i.e., the breakdown of air near high-voltage conductors),
9 which is most noticeable for high-voltage lines during rain or very humid conditions. Since
10 the Bullard Wash SEZ is located in an arid desert environment, these emissions would be small,
11 and potential impacts on ambient air quality associated with transmission lines would be
12 negligible, considering the infrequent occurrences and small amount of emissions from corona
13 discharges.

14 15 16 **8.2.13.2.3 Decommissioning/Reclamation**

17
18 As discussed in Section 5.11.1.4, decommissioning/reclamation activities are similar to
19 construction activities but are on a more limited scale and of shorter duration. Potential impacts
20 on ambient air quality would be correspondingly less than those from construction activities.
21 Decommissioning activities would last for a short period, and their potential impacts would be
22 moderate and temporary. The same mitigation measures adopted during the construction phase
23 would also be implemented during the decommissioning phase (Section 5.11.3).

24 25 26 **8.2.13.3 SEZ-Specific Design Features and Design Feature Effectiveness**

27
28 No SEZ-specific design features are required. Limiting dust generation during
29 construction and operations at the proposed Bullard Wash SEZ (such as increased
30 watering frequency or road paving or treatment) is a required design feature under
31 BLM's proposed Solar Energy Program. These extensive fugitive dust control measures
32 would keep off-site PM levels as low as possible during construction.

1 **8.2.14 Visual Resources**

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3
4 **8.2.14.1 Affected Environment**

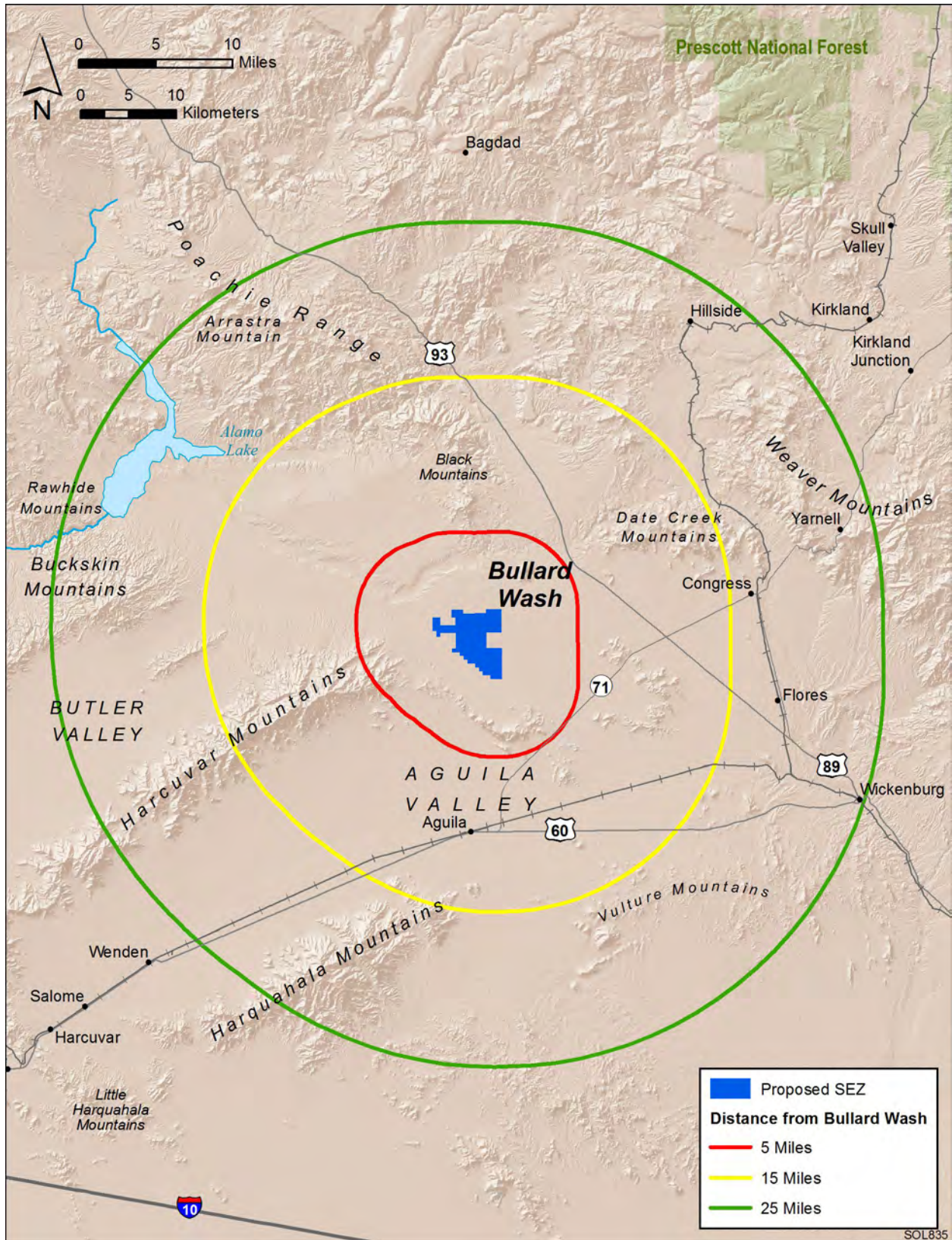
5
6 The proposed Bullard Wash SEZ is located in Yavapai County in southwestern Arizona.
7 The western border of the SEZ is 53 mi (85 km) east of the California border. The SEZ occupies
8 7,239 acres (29 km²) and extends about 4.5 mi (7.2 km) east to west and north to south. The SEZ
9 is located within the Sonoran Basin and Range Level III ecoregion, which contains scattered low
10 mountains. The area has large tracts of federally owned land. The Sonoran Basin and Range is
11 slightly hotter than the Mojave Basin and Range to the north and contains large areas of palo
12 verde-cactus shrub and giant saguaro cactus, as well as creosote bush (EPA 2002). The SEZ
13 ranges in elevation from 2,315 ft (706 m) in the western portion to 2,580 ft (786 m) in the
14 northeastern portion.

15
16 The SEZ is in a valley bounded by mountain ranges to the north and southwest, with
17 open views to the east and northwest. The Black Mountains are 3.8 mi (6.1 km) north of the
18 SEZ; the lone peak of Black Mountain is 2.5 mi (4 km) northeast of the SEZ. The Harcuvar
19 Mountains are 4 mi (6 km) southwest of the SEZ. The Date Creek Mountains are about 8 mi
20 (13 km) east-northeast of the SEZ. These mountains include peaks generally between 3,000 and
21 4,000 ft (914 and 1,219 m) in elevation, but with some peaks higher than 5,000 ft (1,524 m). The
22 valley containing the SEZ extends about 12 mi (19 km) northwest-southeast and is about 7 mi
23 (11 km) wide.

24
25 The SEZ is on the flat plain of the valley floor, with the strong horizon line and
26 surrounding mountain ranges being the dominant visual features. The SEZ slopes gently down
27 from northeast to southwest, with numerous washes crossing the SEZ in the same direction,
28 especially in the northern portion. The surrounding mountains are generally brown in color, but
29 distant mountains appear blue to purple. In contrast, tan-colored sand dominates the desert floor,
30 which is highlighted with the olive-green of creosotebush and the deeper greens of Joshua trees,
31 prickly pear, and barrel cacti. The locations of the SEZ and surrounding mountain ranges are
32 shown in Figure 8.2.14.1-1.

33
34 The Bullard Wash SEZ is more heavily vegetated than most of the other proposed SEZs
35 analyzed in the PEIS, with green vegetation nearly covering the sandy valley floor. Vegetation
36 within the SEZ is predominantly scrubland, with creosotebush and other low shrubs dominating.
37 During a September 2009 site visit, the vegetation presented a limited range of greens (mostly
38 olive green of creosotebushes) with some grays and tans (from lower shrubs), with medium to
39 coarse textures, and generally low visual interest. Joshua trees and ocotillo add interesting form
40 and vertical line contrasts where they occur, and the rounded forms of trees add form and color
41 contrast in some areas. The vegetation is tall enough and dense enough in some areas to provide
42 screening of views from non-elevated viewpoints.

43
44 No permanent surface water is present within the SEZ; however, numerous washes cross
45 the SEZ, especially in the northern portion.



2 **FIGURE 8.2.14.1-1 Proposed Bullard Wash SEZ and Surrounding Lands**

1 Cultural disturbances visible within the SEZ include fences and a few dirt roads. The
2 area is isolated, with no substantial development nearby. However, military jet activity occurs
3 frequently over the SEZ. Off-site cultural disturbances include a transmission line 3 to 4 mi (5 to
4 6 km) northeast of the SEZ, a road immediately north of the SEZ, and a private residence with a
5 windmill and corrals. These cultural modifications detract very slightly from the scenic quality
6 of the SEZ. The SEZ sufficiently large that from many locations within the SEZ, these features
7 are either not visible or are so distant as to have minimal effect on views. From most locations
8 within the SEZ, the landscape is natural in appearance, with little or no disturbance visible.
9

10 Although overall the general lack of topographic relief, water, and physical variety
11 results in low scenic value, the scenic value in some locations in the SEZ is not uniformly low.
12 Because of the flatness of the land and the breadth of the surrounding valley, the SEZ presents
13 a panoramic landscape with sweeping views of the nearby mountains that add significantly to
14 the scenic values within the SEZ viewshed. In general, the upper slopes of the mountains appear
15 to be devoid of vegetation, and the varied and irregular forms and brown to tan colors of the
16 mountains provide pleasing visual contrasts to the strong horizontal line, green vegetation, and
17 light sand of the valley floor, particularly when viewed from nearby locations within the SEZ.
18 The mountain slopes and peaks surrounding the SEZ are visually pristine and enhance the scenic
19 quality of the area. Panoramic views of the SEZ are shown in Figures 8.2.14.1-2, 8.2.14.1-3,
20 and 8.2.14.1-4.
21

22 The BLM conducted a VRI for the SEZ and surrounding lands in 2005 (BLM 2010e);
23 however, the VRI was not completed in time for the new data to be included in this draft PEIS.
24 The new VRI data will be incorporated into the analyses presented in the final PEIS. The VRI
25 evaluates BLM-administered lands on the basis of scenic quality; sensitivity level (in terms of
26 public concern for preservation of scenic values in the evaluated lands); and distance from travel
27 routes or key observation points (KOPs). Based on these three factors, BLM-administered lands
28 are placed into one of four Visual Resource Inventory classes, which represent the relative value
29 of the visual resources. Classes I and II are the most valued; Class III represents a moderate
30 value; and Class IV represents the least value. Class I is reserved for specially designated areas,
31 such as national wildernesses and other congressionally and administratively designated areas
32 where decisions have been made to preserve a natural landscape. Class II is the highest rating for
33 lands without special designation. More information about VRI methodology is available in
34 Section 5.12 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).
35

36 The Bradshaw-Harquahala Record of Decision and Approved Resource Management
37 Plan (BLM 2010b) indicates that the SEZ is managed as visual resource management (VRM)
38 Class IV. VRM Class IV permits major modification of the existing character of the landscape.
39 More information about the BLM VRM program is available in Section 5.12 and in BLM
40 Manual Handbook 8400, *Visual Resource Management* (BLM 1984).
41
42

43 **8.2.14.2 Impacts** 44

45 The potential for impacts from utility-scale solar energy development on visual resources
46 within the proposed Bullard Wash SEZ and surrounding lands, as well as the impacts of related

1



2

FIGURE 8.2.14.1-2 Approximately 120° Panoramic View toward the Proposed Bullard Wash SEZ from Alamo Road near Northeast Corner of the SEZ, Facing Southwest, with Harcuvar Mountains in Background

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FIGURE 8.2.14.1-3 Approximately 180° Panoramic View toward the Proposed Bullard Wash SEZ from Alamo Road near North Central Portion of the SEZ, Facing South, with Harcuvar Mountains in Background

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9

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11



12

FIGURE 8.2.14.1-4 Approximately 120° Panoramic View toward the Proposed Bullard Wash SEZ from Alamo Road near Northwest Corner of the SEZ, Facing Southeast, with Harcuvar Mountains in Background

13

1 developments (e.g., access roads and transmission lines) outside of the SEZ, is presented in
2 this section.

3
4 Site-specific impact assessment is needed to systematically and thoroughly assess visual
5 impact levels for a particular project. Without precise information about the location of a project
6 and a relatively complete and accurate description of its major components and their layout, it is
7 not possible to assess precisely the visual impacts associated with the facility. However, if the
8 general nature and location of a facility are known, a more generalized assessment of potential
9 visual impacts can be made by describing the range of expected visual changes and discussing
10 contrasts typically associated with such changes. In addition, a general analysis can identify
11 sensitive resources that may be at risk if a future project is sited in a particular area. Detailed
12 information about the methodology used for the visual impact assessment conducted for this
13 PEIS, including assumptions and limitations, is presented in Appendix M.

14
15 *Potential Glint and Glare Impacts.* Similarly, the nature and magnitude of potential
16 glint-and glare-related visual impacts for a given solar facility are highly dependent on viewer
17 position, sun angle, the nature of the reflective surface and its orientation relative to the sun and
18 the viewer, atmospheric conditions, and other variables. The determination of potential impacts
19 from glint and glare from solar facilities within a given proposed SEZ would require precise
20 knowledge of these variables, which is not possible given the scope of this PEIS. Therefore, the
21 following analysis does not describe or suggest potential contrast levels arising from glint and
22 glare for facilities that might be developed within the SEZ; however, it should be assumed that
23 glint and glare are possible visual impacts from *any* utility-scale solar facility, regardless of size,
24 landscape setting, or technology type. The occurrence of glint and glare at solar facilities could
25 potentially cause large though temporary increases in brightness and visibility of the facilities.
26 The visual contrast levels projected for sensitive visual resource areas discussed in the following
27 analysis do not account for potential glint and glare effects; however, these effects would be
28 incorporated into a future site- and project-specific assessment that would be conducted for
29 proposed utility-scale solar energy projects. For more information about potential glint and glare
30 impacts associated with utility-scale solar energy facilities, see Section 5.12 of this PEIS.

31 32 33 **8.2.14.2.1 Impacts on the Proposed Bullard Wash SEZ**

34
35 Some or all of the SEZ could be developed for one or more utility-scale solar energy
36 projects, utilizing one or more of the solar energy technologies described in Appendix E.
37 Because of the industrial nature and large size of utility-scale solar energy facilities, large visual
38 impacts on the SEZ would occur as a result of the construction, operation, and decommissioning
39 of solar energy projects. In addition, large impacts could occur at solar facilities utilizing highly
40 reflective surfaces or major light-emitting components (solar dish, parabolic trough, and power
41 tower technologies), with lesser impacts associated with reflective surfaces expected from PV
42 facilities. These impacts would be expected to involve major modification of the existing
43 character of the landscape and would likely dominate nearby views. Additional, and potentially
44 large, impacts would occur as a result of the construction, operation, and decommissioning of
45 associated access roads and electric transmission lines. While the primary visual impacts
46 associated with solar energy development within the SEZ would occur during daylight hours,

1 lighting required for utility-scale solar energy facilities would be a potential source of visual
2 impacts at night, both within the SEZ and on surrounding lands.

3
4 Common and technology-specific visual impacts from utility-scale solar energy
5 development, as well as impacts associated with electric transmission lines, are discussed in
6 Section 5.12 of this PEIS. Impacts would last throughout construction, operation, and
7 decommissioning, and some impacts could continue after project decommissioning. Visual
8 impacts resulting from solar energy projects in the SEZ would be in addition to impacts from
9 solar energy and other projects that may occur on other public or private lands within the SEZ
10 viewshed. For discussion of cumulative impacts, see Section 8.2.22.4.13 of this PEIS.

11
12 The changes described above would be expected to be consistent with BLM VRM
13 objectives for VRM Class IV, as seen from nearby KOPs. VRM Class IV is the current
14 designation for the area that would be occupied by the proposed Bullard Wash SEZ. More
15 information about impact determination using the BLM VRM program methodology is available
16 in Section 5.12 and in BLM Manual Handbook 8431-1, *Visual Resource Contrast Rating*
17 (BLM 1986b).

18
19 Implementation of the programmatic design features intended to reduce visual impacts
20 (described in Appendix A, Section A.2.2) would be expected to reduce visual impacts associated
21 with utility-scale solar energy development within the SEZ; however, the degree of effectiveness
22 of these design features could be assessed only at the site- and project-specific level. Given the
23 large scale, reflective surfaces, and strong regular geometry of utility-scale solar energy facilities
24 and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities
25 away from sensitive visual resource areas and other sensitive viewing areas would be the primary
26 means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures
27 would generally be limited, but would be important to reduce visual contrasts to the greatest
28 extent possible.

31 ***8.2.14.2.2 Impacts on Lands Surrounding the Proposed Bullard Wash SEZ***

32
33 Because of the large size of utility-scale solar energy facilities and the generally flat,
34 open nature of the proposed SEZ, lands outside the SEZ would be subjected to visual impacts
35 from facility construction, operation, and decommissioning. The affected areas and extent of
36 impacts would depend on a number of visibility factors and viewer distance (for a detailed
37 discussion of visibility and related factors, see Section 5.12). A key component in determining
38 impact levels is the intervisibility between the project and potentially affected lands; if
39 topography, vegetation, or structures screen the project from viewer locations, there is no impact.

40
41 Preliminary viewshed analyses were conducted to identify which lands around the
42 proposed SEZ could have views of solar facilities in at least some portion of the SEZ
43 (see Appendix M for information on the assumptions and limitations of the methods used).
44 Four viewshed analyses were conducted, assuming four different heights representative of
45 project elements associated with potential solar energy technologies: PV and parabolic trough
46 arrays (24.6 ft [7.5 m]), solar dishes and power blocks for CSP technologies (38 ft [11.6 m]),

1 transmission towers and short solar power towers (150 ft [45.7 m]), and tall solar power towers
2 (650 ft [198.1 m]). Viewshed maps for the SEZ for all four solar technology heights are
3 presented in Appendix N.
4

5 Figure 8.2.14.2-1 shows the combined results of the viewshed analyses for all four solar
6 technologies. The colored segments indicate areas with clear lines of sight to one or more areas
7 within the SEZ and from which solar facilities within these areas of the SEZ would be expected
8 to be visible, assuming the absence of screening vegetation or structures and adequate lighting
9 and other atmospheric conditions. The light brown areas are locations from which PV and
10 parabolic trough arrays in the SEZ could be visible. Solar dishes and power blocks for CSP
11 technologies would be visible from the areas shaded in light brown and the additional areas
12 shaded in light purple. Transmission towers and short solar power towers would be visible from
13 the areas shaded light brown, light purple, and the additional areas shaded in dark purple. Power
14 tower facilities in the SEZ could be visible from areas shaded light brown, light purple, dark
15 purple, and at least the upper portions of power tower receivers could be visible from the
16 additional areas shaded in medium brown.
17

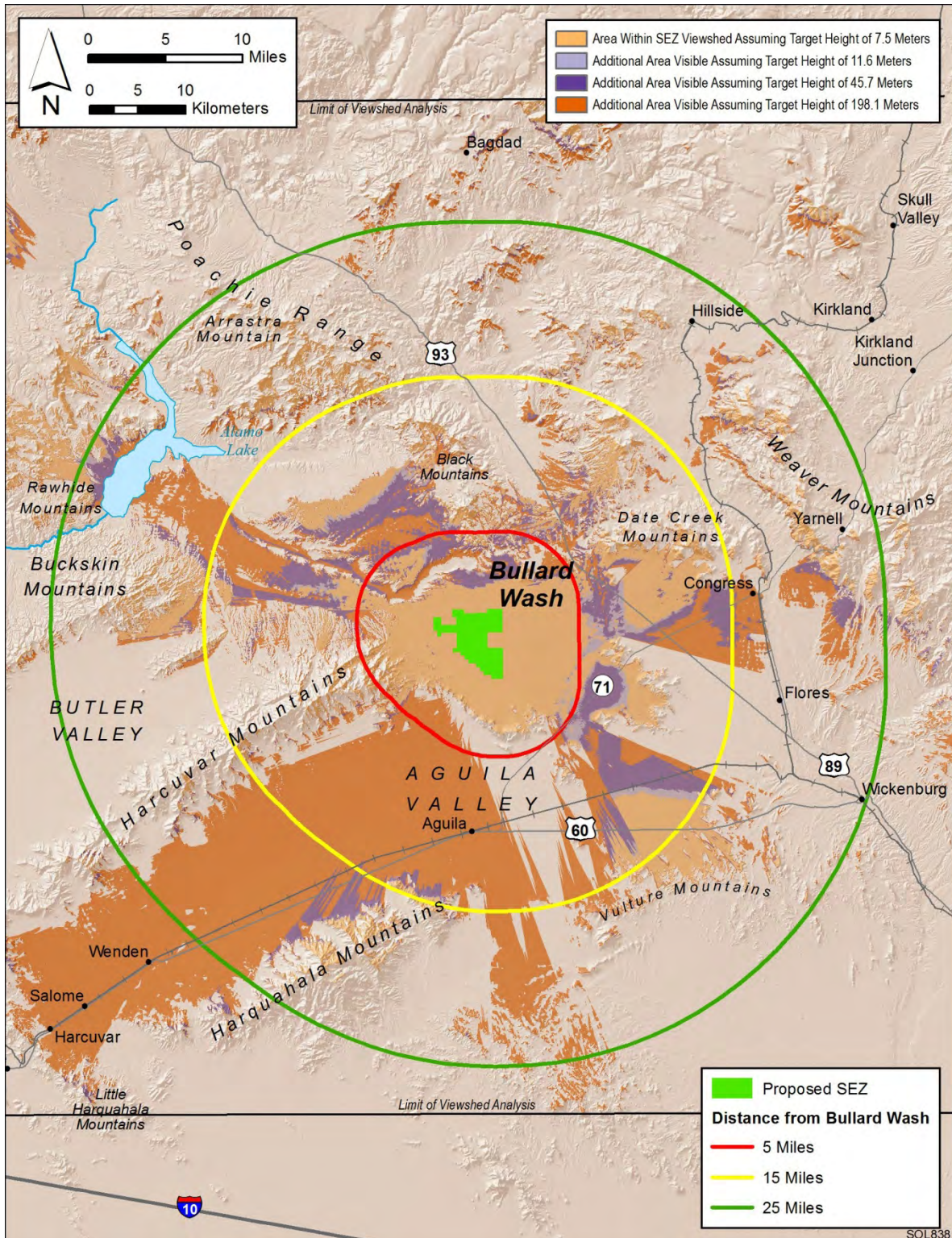
18 For the following visual impact discussion, viewsheds for the tall solar power tower
19 (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) are shown in figures and
20 discussed in the text. These heights represent the maximum and minimum landscape visibility
21 for solar energy technologies analyzed in the PEIS. Viewsheds for solar dish and CSP
22 technology power blocks (38 ft [11.6 m]), and transmission towers and short solar power
23 towers (150 ft [45.7 m]) are presented in Appendix N. The visibility of those facilities would
24 fall between that for tall power towers and PV and parabolic trough arrays.
25
26

27 **Impacts on Selected Federal-, State-, and BLM-Designated Sensitive Visual** 28 **Resource Areas** 29

30 Figure 8.2.14.2-2 shows the results of a geographical information system (GIS) analysis
31 that overlays selected federal, state, and BLM-designated sensitive visual resource areas onto
32 the combined viewsheds for the tall solar power tower (650 ft [198.1 m]) and PV and parabolic
33 trough array (24.6 ft [7.5 m]) in order to illustrate which of these sensitive visual resource areas
34 could have views of solar facilities within the SEZ and therefore potentially would be subject to
35 visual impacts from those facilities. Distance zones that correspond with BLM's VRM system-
36 specified foreground–middleground distance (5 mi [8 km]), background distance (15 mi
37 [24 km]), and a 25-mi (40-km) distance zone are shown as well to indicate the effect of distance
38 from the SEZ on impact levels.
39

40 The scenic resources included in the analyses were as follows:
41

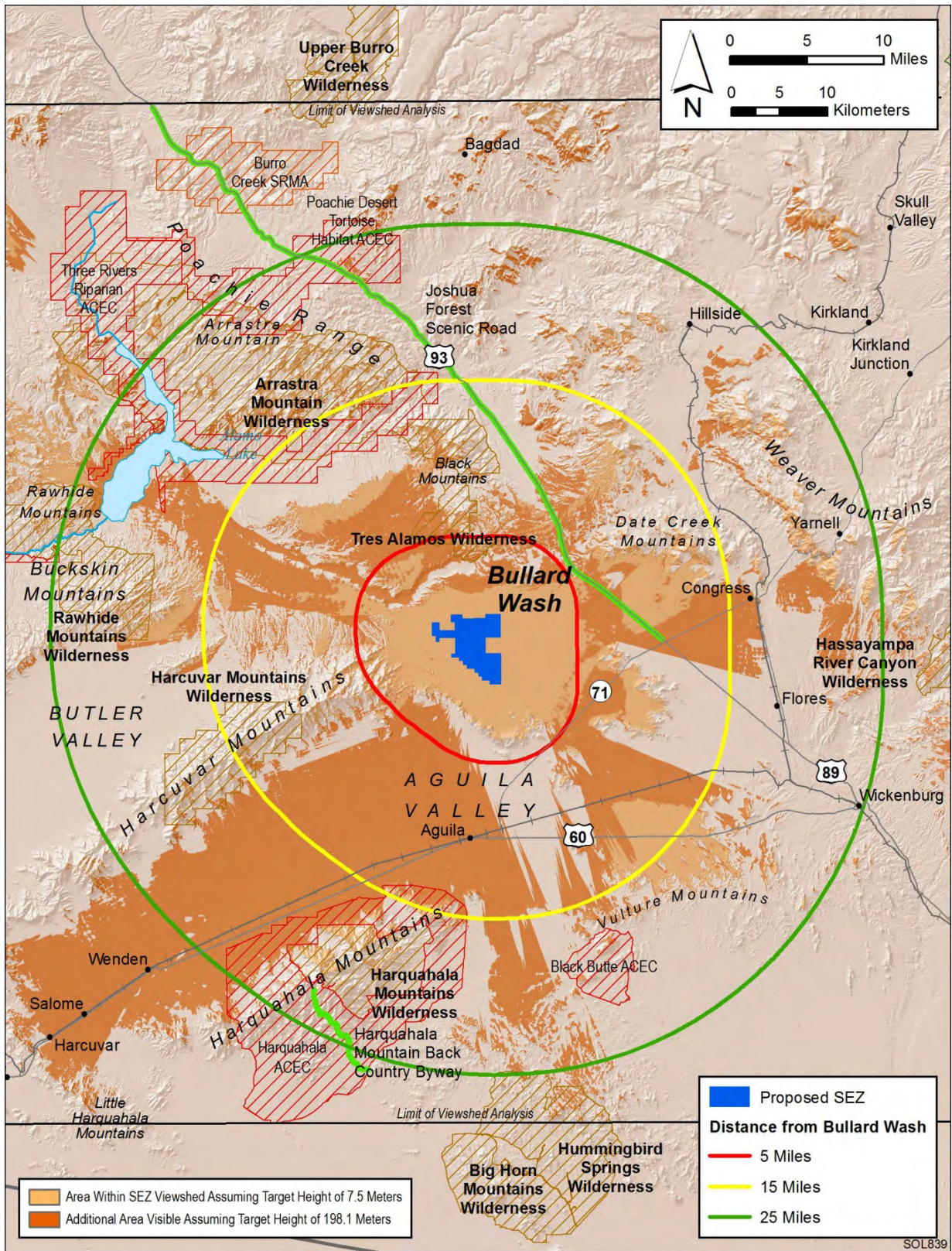
- 42 • National Parks, National Monuments, National Recreation Areas, National
43 Preserves, National Wildlife Refuges, National Reserves, National
44 Conservation Areas, National Historic Sites;
- 45 • Congressionally authorized Wilderness Areas;
- 46



1

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3
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5

FIGURE 8.2.14.2-1 Viewshed Analyses for the Proposed Bullard Wash SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)



1
 2 **FIGURE 8.2.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft**
 3 **(198.1-m) and 24.6-ft (7.5-m) Viewsheds for the Proposed Bullard Wash SEZ**

- 1 • Wilderness Study Areas;
- 2
- 3 • National Wild and Scenic Rivers;
- 4
- 5 • Congressionally authorized Wild and Scenic Study Rivers;
- 6
- 7 • National Scenic Trails and National Historic Trails;
- 8
- 9 • National Historic Landmarks and National Natural Landmarks;
- 10
- 11 • All-American Roads, National Scenic Byways, State Scenic Highways; and
- 12 BLM- and USFS-designated scenic highways/byways;
- 13
- 14 • BLM-designated Special Recreation Management Areas; and
- 15
- 16 • ACECs designated because of outstanding scenic qualities.
- 17

18 Potential impacts on specific sensitive resource areas visible from and within 25 mi
19 (40 km) of the proposed Bullard Wash SEZ are discussed below. The results of this analysis are
20 also summarized in Table 8.2.14.2-1. Further discussion of impacts on these areas is available in
21 Sections 8.2.3 (Specially Designated Areas and Lands with Wilderness Character) and 8.2.17
22 (Cultural Resources) of the PEIS.

23
24 The following visual impact analysis describes *visual contrast levels* rather than *visual*
25 *impact levels*. *Visual contrasts* are changes in the landscape as seen by viewers, including
26 changes in the forms, lines, colors, and textures of objects in the landscape. A measure of *visual*
27 *impact* includes potential human reactions to the visual contrasts arising from a development
28 activity, based on viewer characteristics, including attitudes and values, expectations, and other
29 characteristics that are viewer- and situation-specific. Accurate assessment of visual impacts
30 requires knowledge of the potential types and numbers of viewers for a given development and
31 their characteristics and expectations; specific locations where the project might be viewed from;
32 and other variables that were not available or not feasible to incorporate in this PEIS analysis.
33 These variables would be incorporated into a future site- and project-specific assessment that
34 would be conducted for specific proposed utility-scale solar energy projects. For more
35 discussion of visual contrasts and impacts, see Section 5.12 of the PEIS.

36 37 38 ***Wilderness Areas***

- 39 • *Arrastra Mountain*—Arrastra Mountain is a 129,413-acre (523.716-km²)
40 congressionally designated wilderness area (WA) located 8.6 mi (13.8 km)
41 north of the SEZ. The WA contains scenic landscapes and unique natural
42 features, including Artillery Peak (a volcanic cone) and the pristine
43 Peoples Canyon.
44
45

TABLE 8.2.14.2-1 Selected Potentially Affected Sensitive Visual Resources within the 25-mi (40-km) Viewshed of the Proposed Bullard Wash SEZ, Assuming a Target Height of 650 ft (198.1 m)

Feature Type	Feature Name and (Total Acreage/Highway Length) ^a	Feature Area or Linear Distance		
		Visible within 5 mi	Visible between	
			5 and 15 mi	15 and 25 mi
WAs	Arrastra Mountain (129,413 acres)	0 acres	3,653 acres (3%) ^b	13,074 acres (10%)
	Harcuvar Mountains (25,178 acres)	0 acres	796 acres (3%)	1,240 acres (5%)
	Harquahala Mountains (22,947 acres)	0 acres	0 acres	4,933 acres (22%)
	Hummingbird Springs (31,429 acres)	0 acres	0 acres	3 acres (0.01%)
	Rawhide Mountains (37,968 acres)	0 acres	0 acres	4,433 acres (12%)
	Tres Alamos (8,278 acres)	1,694 acres (21%)	3,450 acres (42%)	0 acres
Scenic Byway	Joshua Forest Scenic Road	0 mi	13.9 mi	0.12 mi
ACECs designated for outstanding scenic values	Three Rivers Riparian (87,716 acres)	0 acres	503 acres (0.6%)	3,478 acres (4%)
	Poachie Desert Tortoise (33,512 acres)	0 acres	0 acres	1,764 acres (5%)
	Harquahala Mountains (77,201 acres)	0 acres	3,180 acres (4%)	13,012 acres (17%)
	Black Butte (9,549 acres)	0 acres	0 acres	422 acres (4%)

^a To convert acres to km², multiply by 0.004047; to convert mi to km, multiply by 1.609.

^b Percentage of total feature acreage or road length viewable.

1 Within the WA, solar facilities in the SEZ would be visible from about
2 16,727 acres (67.692 km²) in the 650-ft (198.1-m) viewshed, or 13% of the
3 total WA acreage, and 10,383 acres (42.019 km²) in the 24.6-ft (7.5-m)
4 viewshed, or 8% of the total WA acreage. As shown in Figure 8.2.14.2-2, the
5 visible area of the WA extends beyond 25 mi (40 km) from the northwestern
6 boundary of the SEZ. The upper slopes and peak of the mountains are barren,
7 with little opportunity for screening.
8

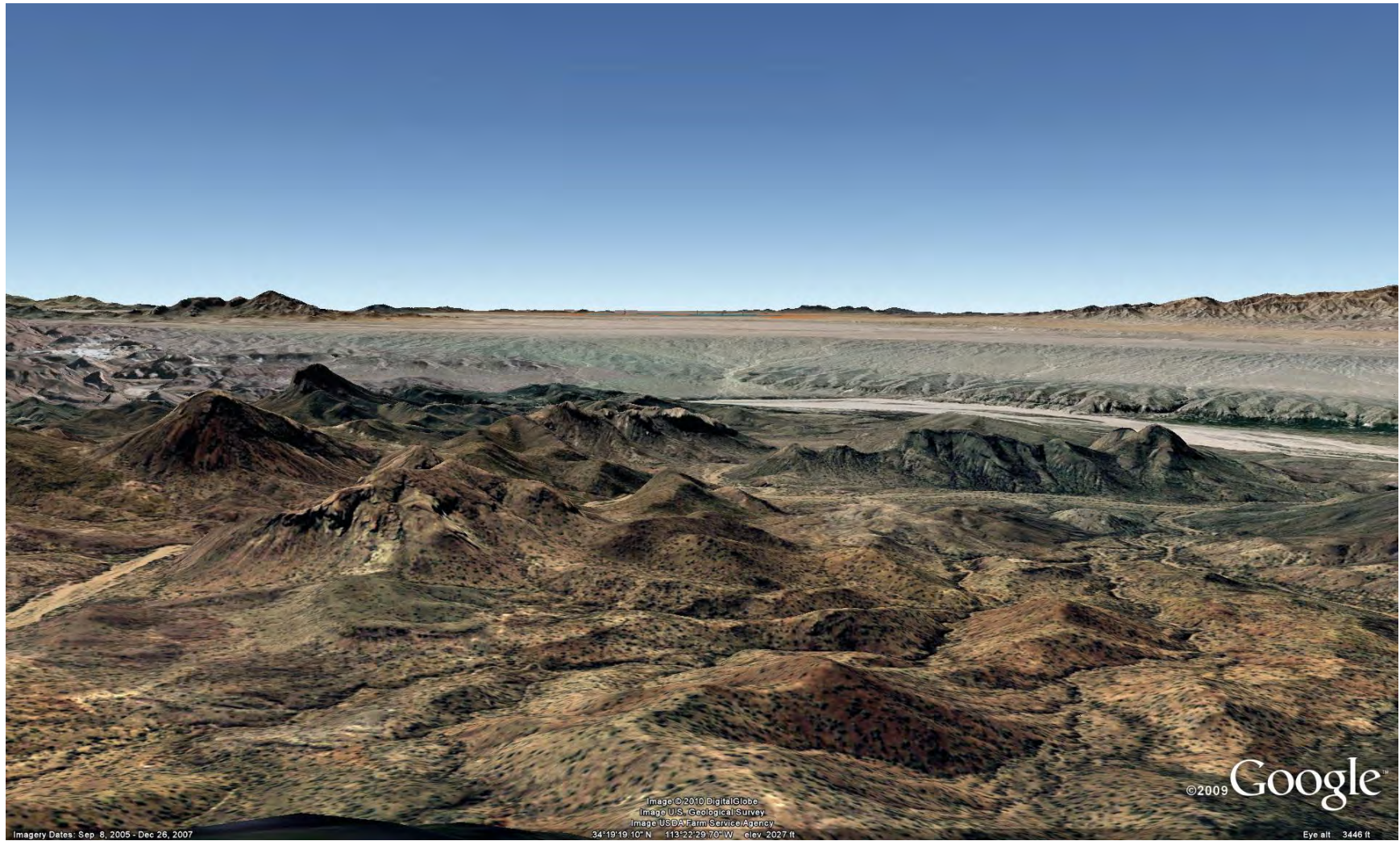
9 Figure 8.2.14.2-3 is a Google Earth visualization of the SEZ as seen from an
10 unnamed peak (elevation of about 3,410 ft [1,040 m] above mean sea level) in
11 the central portion of the WA, about 18 mi (29 km) northwest of the northwest
12 corner of the SEZ. The visualization includes simplified wireframe models of
13 a hypothetical solar power tower facility. The models were placed within the
14 SEZ as a visual aid for assessing the approximate size and viewing angle of
15 utility-scale solar facilities. The receiver towers depicted in the visualization
16 are properly scaled models of a 459-ft (140-m) power tower with an 867-acre
17 (3.5-km²) field of 12-ft (3.7-m) heliostats, each representing about 100 MW
18 of electric generating capacity. Two models were placed in the SEZ for this
19 and other visualizations shown in this section of the PEIS. In the visualization,
20 the SEZ area is depicted in orange, the heliostat fields in blue.
21

22 The viewpoint in the visualization is about 1,000 ft (300 m) higher in
23 elevation than the SEZ. Because of the long distance to the SEZ, the SEZ
24 would occupy a very small portion of the horizontal field of view. The
25 collector/reflector arrays of solar facilities within the SEZ would be seen
26 nearly edge-on, which would reduce their apparent size and make their strong
27 regular geometry less apparent. The edge-on view would also cause them to
28
29

GOOGLE EARTH™ VISUALIZATIONS

The visual impact analysis discussion in this section utilizes three-dimensional Google Earth™ perspective visualizations of hypothetical solar facilities placed within the SEZ. The visualizations include simplified wireframe models of a hypothetical solar power tower facility. The models were placed at various locations within the SEZ as visual aids for assessing the approximate size and viewing angle of utility-scale solar facilities. The visualizations are intended to show the apparent size, distance, and configuration of the SEZ, as well as the apparent size of a typical utility-scale solar power tower project and its relationship to the surrounding landscape, as viewed from potentially sensitive visual resource areas within the viewshed of the SEZ.

The visualizations are not intended to be realistic simulations of the actual appearance of the landscape or of proposed utility-scale solar energy projects. The placement of models within the SEZ did not reflect any actual planned or proposed projects within the SEZ, and did not take into account engineering or other constraints that would affect the siting or choice of facilities for this particular SEZ. The number of facility models placed in the SEZ does not reflect the 80% development scenario analyzed in this PEIS, but it should be noted that the discussion of expected visual contrast levels does account for the 80% development scenario. A solar power tower was chosen for the models because the unique height characteristics of power tower facilities make their visual impact potential extend beyond other solar technology types.



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FIGURE 8.2.14.2-3 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from an Unnamed Peak in the Central Portion of the Arrastra Mountain WA

1 appear to repeat the strong line of the horizon, which would tend to reduce
2 visual contrast.

3
4 If power tower facilities were located within the SEZ, the light from the
5 operating receivers would likely appear as distant points of light on the
6 southeastern horizon during the day and, if more than 200 ft (61 m) tall, would
7 have flashing red or white navigation warning lights at night that could be
8 visible from this location.

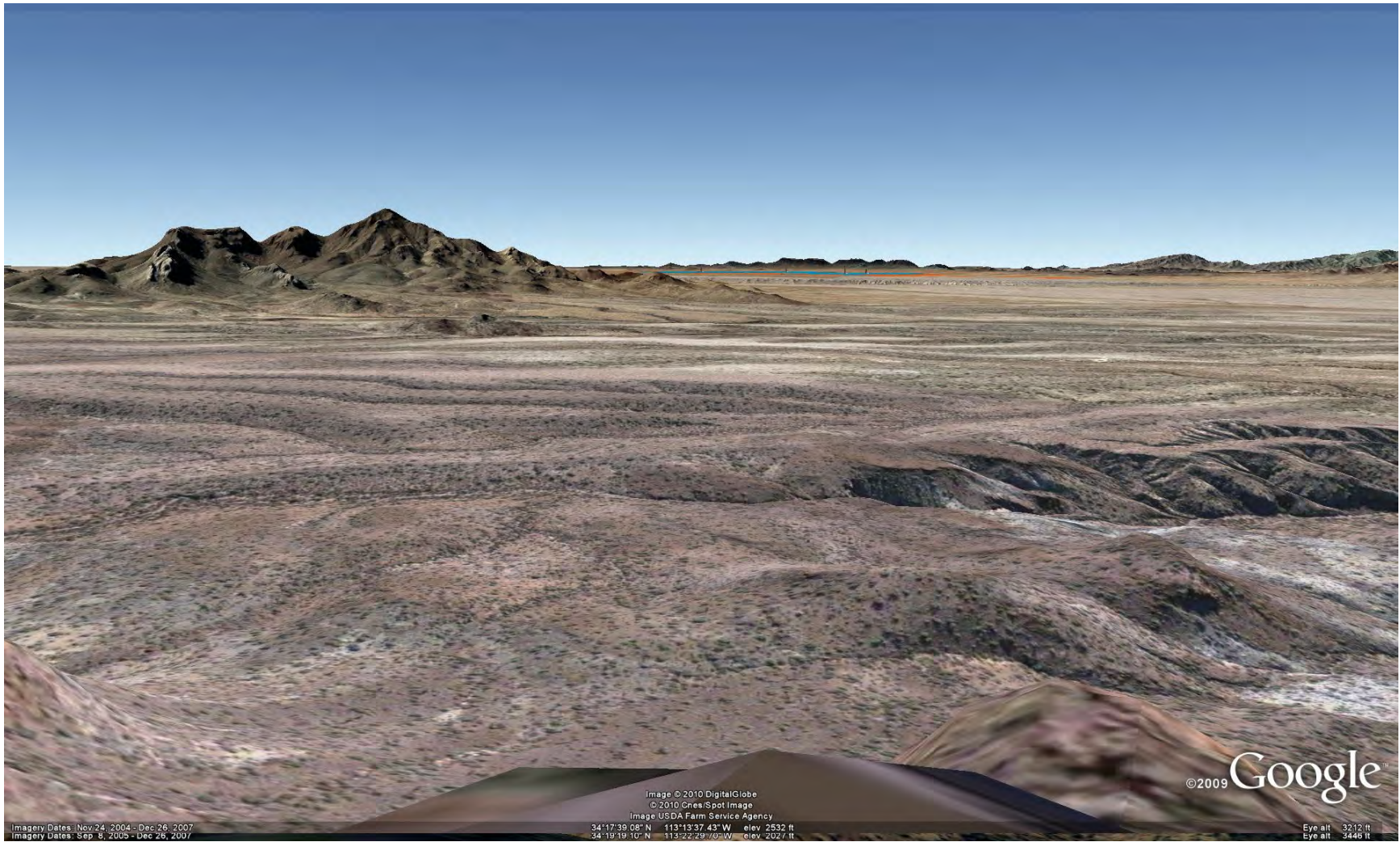
9
10 Potential visual contrast levels from solar energy development within the SEZ
11 would vary depending on the type, size, and number of solar energy projects
12 within the SEZ, project location and layout, lighting, atmospheric conditions,
13 and other visibility factors. Under the 80% development scenario analyzed in
14 the PEIS, weak visual contrasts from solar energy development within the
15 SEZ would be expected at this viewpoint.

16
17 Figure 8.2.14.2-4 is a Google Earth visualization of the SEZ (highlighted in
18 orange) as seen from an unnamed peak in the eastern portion of the WA,
19 about 12 mi (19 km) from the northernmost boundary of the SEZ. The
20 viewpoint is elevated about 1,600 ft (490 m) above the nearest point in
21 the SEZ.

22
23 The visualization suggests that from this viewpoint, the tops of
24 collector/reflector arrays within the SEZ might be visible, but the angle of
25 view would be low because of the distance to the SEZ. The SEZ and solar
26 facilities within it would be seen as a thin band just below the mountains on
27 the southern horizon, and the facilities would tend to repeat the line of the
28 horizon, reducing visual contrast. However, the SEZ would occupy a greater
29 portion of the horizontal field of view than it would as seen from the more
30 distant viewpoint described above.

31
32 If power towers were present within the SEZ, when operating they would
33 likely appear as star-like points of light against a backdrop of the Bullard
34 Wash floor, or the bases of the far eastern end of the Harcuvar Mountains
35 south of the SEZ. At night, if more than 200 ft (61 m) tall, power towers could
36 have red or white flashing hazard navigation lights that could be visible from
37 this location.

38
39 Potential visual contrast levels associated with solar development within the
40 SEZ would vary depending on the project-related and visibility factors noted
41 above. Under the 80% development scenario analyzed in the PEIS, weak to
42 moderate visual contrasts from solar energy development within the SEZ
43 would be expected at this viewpoint. In general, weak to moderate visual
44 contrasts would be expected to be observed from viewpoints within the WA.



1

FIGURE 8.2.14.2-4 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from an Unnamed Peak in the Eastern Portion of the Arrastra Mountain WA

2

3

4

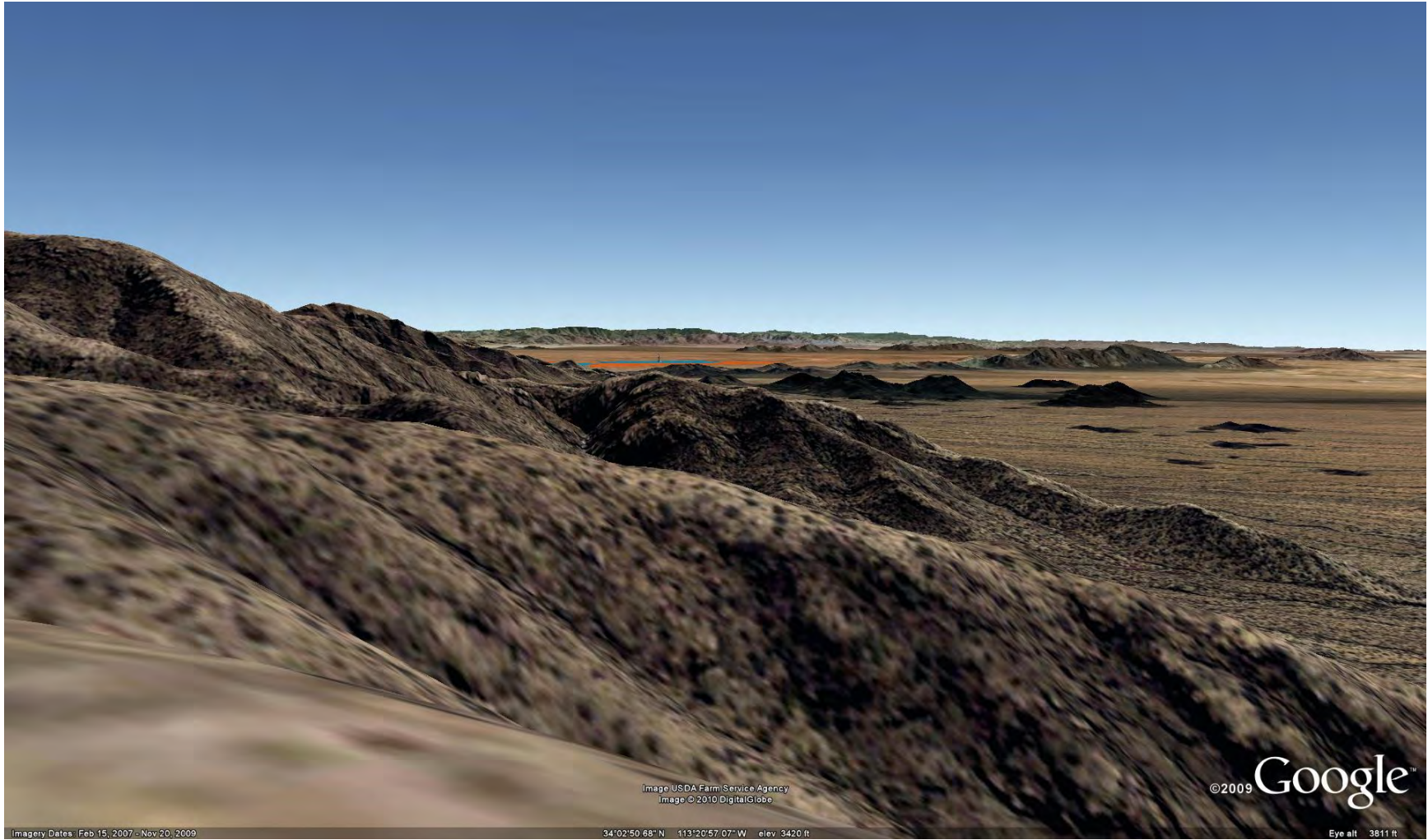
- 1 • *Harcuvar Mountains*—The Harcuvar Mountains WA is a 25,178-acre
2 (102-km²) congressionally designated WA 10 mi (16 km) southwest of the
3 SEZ. Because of its isolation, the Harcuvar Mountains WA offers outstanding
4 opportunities for wilderness recreation and solitude. The canyons and
5 ridgelines provide a high-quality setting for hiking, backpacking, hunting, and
6 climbing. Sightseeing use has increased in recent years and is attributed to the
7 increased number of winter visitors in the Wenden/Salome area
8 (BLM 2009b).

9
10 As shown in Figure 8.2.14.2-2, within 25 mi (40 km) of the SEZ, solar energy
11 facilities could be visible from the northeastern portions of the WA (about
12 2,036 acres [8.2 km²] in the 650-ft [198.1-m] viewshed, or 8% of the total
13 WA acreage, and 1,040 acres [4.2 km²] in the 25-ft [7.5-m] viewshed, or 4%
14 of the total WA acreage). The area of the WA with potential visibility of solar
15 facilities within the SEZ extends to beyond 25 mi (40 km) from the
16 southwestern boundary of the SEZ.

17
18 Figure 8.2.14.2-5 is a Google Earth visualization of the SEZ (highlighted in
19 orange) as seen from an unnamed peak on the eastern boundary of the WA, on
20 the southern side of the Harcuvar Mountains about 11 mi (18 km) from the
21 northernmost boundary of the SEZ. The viewpoint is elevated about 1,400 ft
22 (430 m) above the nearest point in the SEZ. Because the Harcuvar Mountains
23 are generally higher in elevation east of the WA than they are within the WA,
24 views of the SEZ from the WA are screened by mountains outside the WA;
25 the viewpoint selected for this visualization is near the point of maximum
26 visibility of the SEZ within the WA.

27
28 The visualization suggests that from this viewpoint, mountains farther east
29 from this viewpoint near the easternmost boundary of the WA would screen
30 a substantial portion of the SEZ from view. Within the visible portion of the
31 SEZ, the tops of collector/reflector arrays within the SEZ might be visible, but
32 the angle of view would be low because of the 11-mi (18-km) distance to the
33 SEZ. The SEZ and solar facilities within it would be seen as a narrow band
34 just over the tops of the mountains between the viewpoint and the SEZ toward
35 the east. The facilities would tend to repeat the line of the valley floor in
36 which the SEZ is located, reducing visual contrast. The edge-on view would
37 also tend to reduce their apparent size and conceal their strong regular
38 geometry, which would also reduce visual contrast.

39
40 Any operating power towers within the SEZ would be visible as potentially
41 bright star-like points of light atop visible tower structures against a backdrop
42 of the Bullard Wash floor during the day and, if more than 200 ft (61 m) tall,
43 would have navigation warning lights at night that could be visible from this
44 location. Other lighting associated with solar facilities in the SEZ could be
45 visible as well.



1

2 **FIGURE 8.2.14.2-5 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with**
3 **Power Tower Wireframe Models, as Seen from Viewpoint in Eastern Portion of Harcuvar Mountains WA**
4

1 Potential visual contrast levels associated with solar development within the
2 SEZ would vary depending on the project-related and visibility factors noted
3 above, but under the 80% development scenario analyzed in the PEIS, weak
4 visual contrasts from solar energy development within the SEZ would be
5 expected at this viewpoint. Because this viewpoint is near the point of greatest
6 SEZ visibility within the WA, similar or lower visual contrasts would be
7 expected for other viewpoints within the WA.
8

- 9 • *Harquahala Mountains*—The Harquahala Mountains WA is a 22,947-acre
10 (93-km²) congressionally designated WA located 15.6 mi (25 km) away at the
11 point of closest approach southwest of the SEZ. This wilderness contains part
12 of one of western Arizona’s largest desert mountain ranges. The 5,691-ft
13 (1,735-m) high Harquahala Peak, the highest point in southwest Arizona,
14 provides sweeping panoramic views of surrounding desert and distant
15 mountain ranges.
16

17 Within 25 mi (40 km), solar energy facilities within the SEZ could be visible
18 from portions of the northern slopes of the mountains within the WA. Visible
19 areas of the WA within the 25-mi (40-km) radius of analysis total about
20 4,933 acres (20 km²) in the 650-ft (198.1-m) viewshed, or 22% of the total
21 WA acreage, and 3,951 acres (16 km²) in the 24.6-ft (7.5-m) viewshed, or
22 17% of the total WA acreage. As shown in Figure 8.2.14.2-2, the visible area
23 of the WA extends to about 22 mi (35 km) from the southern boundary of the
24 SEZ.
25

26 Figure 8.2.14.2-6 is a Google Earth visualization of the SEZ (highlighted in
27 orange) as seen from an unnamed peak on the boundary of the Harquahala
28 Mountain WA and the ACEC, at the most northeastern point in the WA, 16 mi
29 (26 km) from the southernmost boundary of the SEZ. This is the closest point
30 to the SEZ within the WA; however, visibility of the SEZ in this part of the
31 WA is limited to the immediate vicinity of this peak because of the screening
32 of the SEZ by the mountain in other locations. The viewpoint is elevated
33 about 2,100 ft (640 m) above the nearest point in the SEZ.
34

35 The visualization suggests that from this viewpoint, the SEZ would be viewed
36 across a wide plain containing a large array of rectangular agricultural fields,
37 just beyond the far eastern arm of the Harcuvar Mountains, which would
38 screen some portions of the SEZ from view. Because of the long distance to
39 the SEZ, the SEZ would occupy a small portion of the field of view. Within
40 the visible portion of the SEZ, the tops of collector/reflector arrays might be
41 visible, but the angle of view would be low because of the distance to the
42 SEZ. The SEZ and solar facilities within it would be seen as a narrow band
43 just over the tops of the mountains between the viewpoint and the SEZ, and
44 the facilities would tend to repeat the line of the valley floor in which the SEZ
45 is located, thus reducing visual contrast.

1

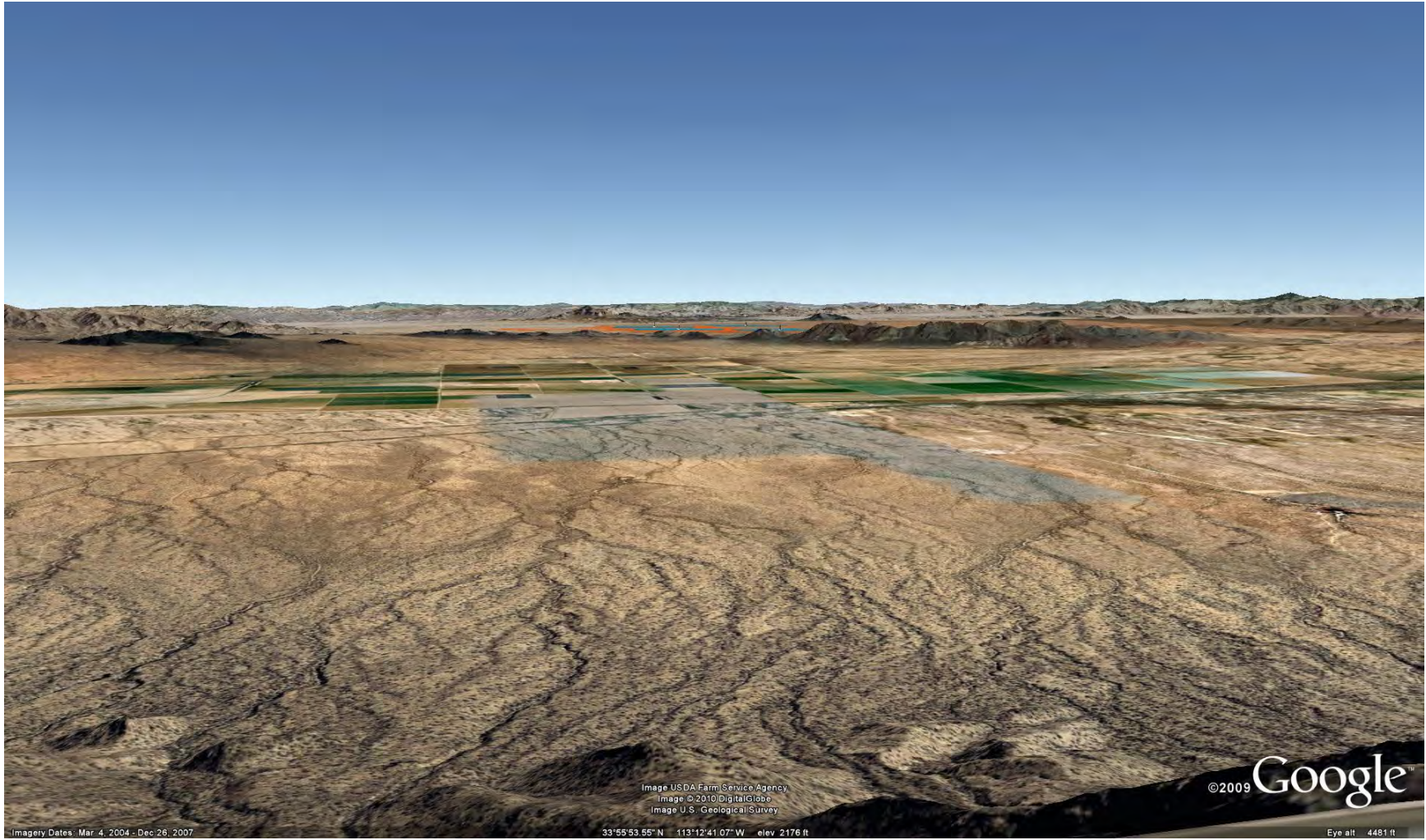


FIGURE 8.2.14.2-6 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint within the Harquahala Mountains WA

1 If power towers were present within the SEZ, they would be visible as distant
2 star-like points of light against a backdrop of the Bullard Wash floor. At night,
3 if more than 200 ft (61 m) tall, the power towers would have navigation
4 warning lights that could be visible from this location.
5

6 Potential visual contrast levels associated with solar development within the
7 SEZ would vary depending on the project-related and visibility factors noted
8 above, but under the 80% development scenario analyzed in the PEIS, weak
9 visual contrasts from solar energy development within the SEZ would be
10 expected at this viewpoint. Other viewpoints within the WA would have less
11 obstructed views of the SEZ; however, they are farther from the SEZ, and
12 expected visual contrasts seen from these viewpoints would be weak.
13

- 14 • *Hummingbird Springs*—The Hummingbird Springs WA is a 31,429-acre
15 (127-km²) congressionally designated WA 25 mi (40 km) from the point
16 of closest approach south of the SEZ. The eastern Big Horn Mountains cross
17 this WA for more than 8 mi (13 km). The area is dominated by Sugarloaf
18 Mountain, a landmark encircled by many lower peaks, hills, washes, and
19 bajadas. This WA offers numerous recreation opportunities.
20

21 As shown in Figure 8.2.14.2-2, visible areas of the WA within the 25-mi
22 (40-km) radius of analysis total about 3 acres (0.01 km²) in the 650-ft
23 (198.1-m) viewshed, or 0.01% of the total WA acreage. None of the WA is
24 visible within the 24.6-ft (7.5-m) viewshed. A small portion of the visible
25 area of the WA extends beyond 25 mi (40 km) from the southern boundary
26 of the SEZ.
27

28 Because of the very long distance to the SEZ, the resultant very low viewing
29 angle, and screening by intervening terrain, only the upper portions of tall
30 power tower receivers would be visible from a very small portion (3 acres
31 [0.01 km²]) of the WA, at a distance of nearly 25 mi (40 km). At night, if
32 more than 200 ft (61 m) tall, power towers would have navigation warning
33 lights that could potentially be visible from the WA. Expected visual impacts
34 from solar energy development within the SEZ would be expected to be
35 minimal.
36

- 37 • *Rawhide Mountains*—Rawhide Mountains WA is a 37,968-acre (154-km²)
38 congressionally designated WA located 19 mi (31 km) at the point of closest
39 approach west of the SEZ. The Rawhide Mountains are low hills punctuated
40 by numerous rugged outcrops. These hills rise from 700 ft (213 m) to an
41 elevation of 2,430 ft (741 m) in elevation.
42

43 Within 25 mi (40 km), solar energy facilities within the SEZ could be visible
44 from portions of the eastern slopes of the mountains within the WA. Areas of
45 the WA within the 25-mi (40-km) radius of analysis total about 4,433 acres
46 (18 km²) in the 650-ft (198.1-m) viewshed, or 12% of the total WA acreage,

1 and 3,351 acres (14 km²) in the 24.6-ft (7.5-m) viewshed, or 9% of the total
2 WA acreage. As shown in Figure 8.2.14.2-2, the visible area of the WA
3 extends to beyond 25 mi (40 km) from the southwestern boundary of the SEZ.
4

5 Figure 8.2.14.2-7 is a Google Earth visualization of the SEZ (highlighted in
6 orange) as seen from an unnamed peak in the eastern portion of the WA,
7 about 20 mi (32 km) from the northwestern corner of the SEZ. The viewpoint
8 is elevated about 710 ft (220 m) above the nearest point in the SEZ.
9

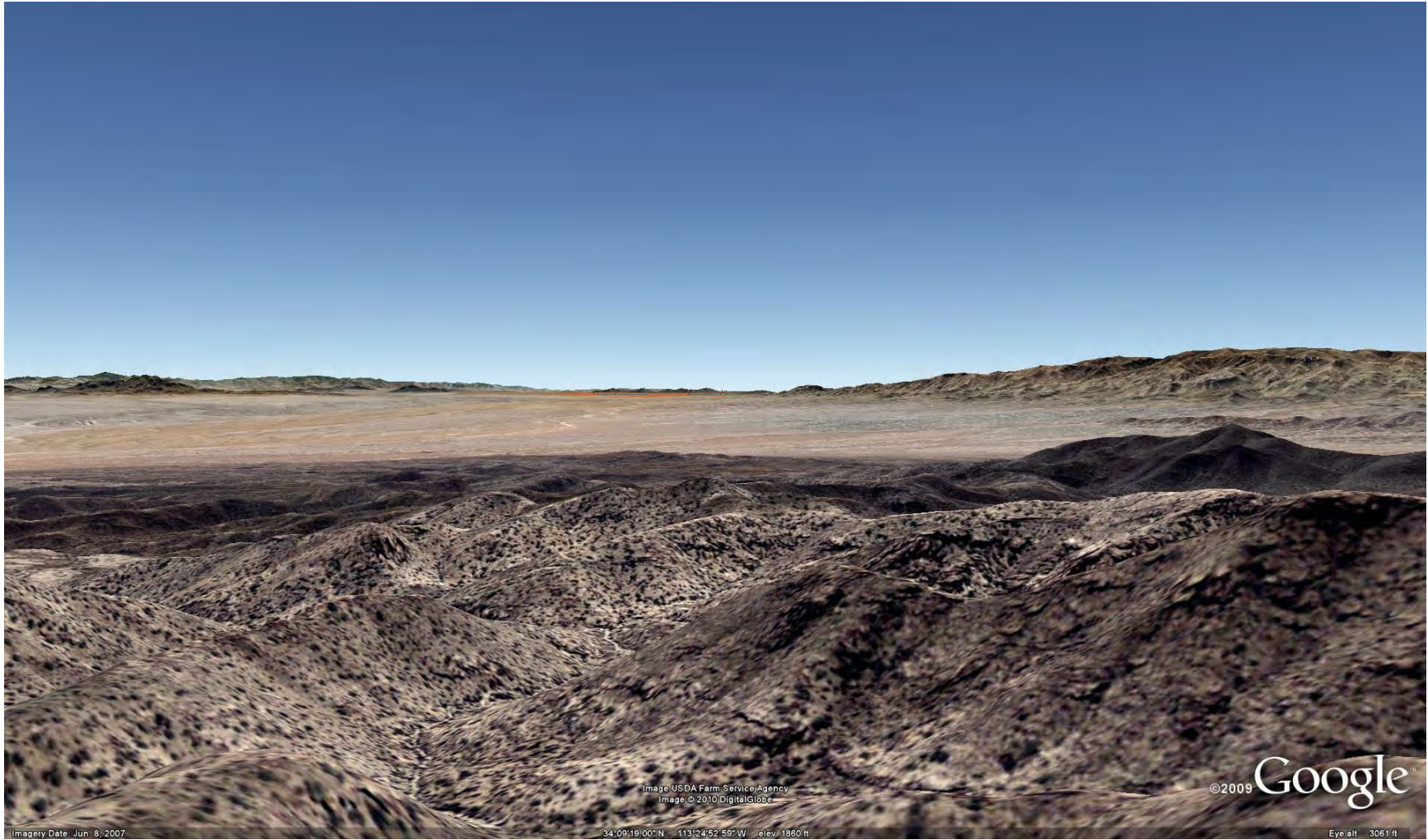
10 The visualization suggests that from this viewpoint, the SEZ would be viewed
11 across a wide plain. Because of the long distance to the SEZ, the SEZ would
12 occupy a very small portion of the field of view, and the vertical angle of view
13 would be very low. The SEZ and solar facilities within it would be seen nearly
14 edge-on and would tend to repeat the line of the horizon, thus reducing visual
15 contrast. The edge-on view would also tend to reduce their apparent size and
16 conceal their strong regular geometry, as well as reduce visual contrast.
17

18 If power towers were present within the SEZ, they would be visible as distant
19 points of light against a backdrop of distant mountains. At night, if more than
20 200 ft (61 m) tall, power towers would have navigation warning lights that
21 could potentially be visible from the WA.
22

23 Potential visual contrast levels associated with solar development within the
24 SEZ would vary depending on the project-related and visibility factors noted
25 above, but under the 80% development scenario analyzed in the PEIS, weak
26 visual contrasts from solar energy development within the SEZ would be
27 expected at this viewpoint. Other viewpoints within the WA are generally
28 either lower in elevation or they are farther from the SEZ than this viewpoint
29 and would be expected to be subject to similar or lower levels of visual
30 contrast associated with solar development within the SEZ.
31

- 32 • *Tres Alamos*—Tres Alamos WA is an 8,278-acre (34-km²) congressionally
33 designated WA located 3.5 mi (5.6 km) at the point of closest approach north
34 of the SEZ. All of the area offers landscapes suitable for hiking, backpacking,
35 sight-seeing, photography, and camping. Sawyer Peak, at 4,293 ft, (1,309 m)
36 elevation, is the highest point in the WA and in the Black Mountains.
37 Wilderness visitation is estimated at less than 200 visits annually and is not
38 expected to increase significantly in the foreseeable future because the area
39 is remote and access is difficult (BLM 2000).
40

41 As shown in Figure 8.2.14.2-2, within 25 mi (40 km), solar energy facilities
42 within the SEZ could be visible from the southern portions of the WA. Visible
43 areas of the WA within the 25-mi (40-km) radius of analysis total about
44 5,144 acres (21 km²) in the 650-ft (198.1-m) viewshed, or 62% of the total
45 WA acreage, and 1,347 acres (5.5 km²) in the 24.6-ft (7.5-m) viewshed, or
46 16% of the total WA acreage. The area of the WA with potential visibility of



1

FIGURE 8.2.14.2-7 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint within the Rawhide Mountains WA

1 solar facilities within the SEZ extends to about 7.2 mi (11.6 km) from the
2 northern boundary of the SEZ.

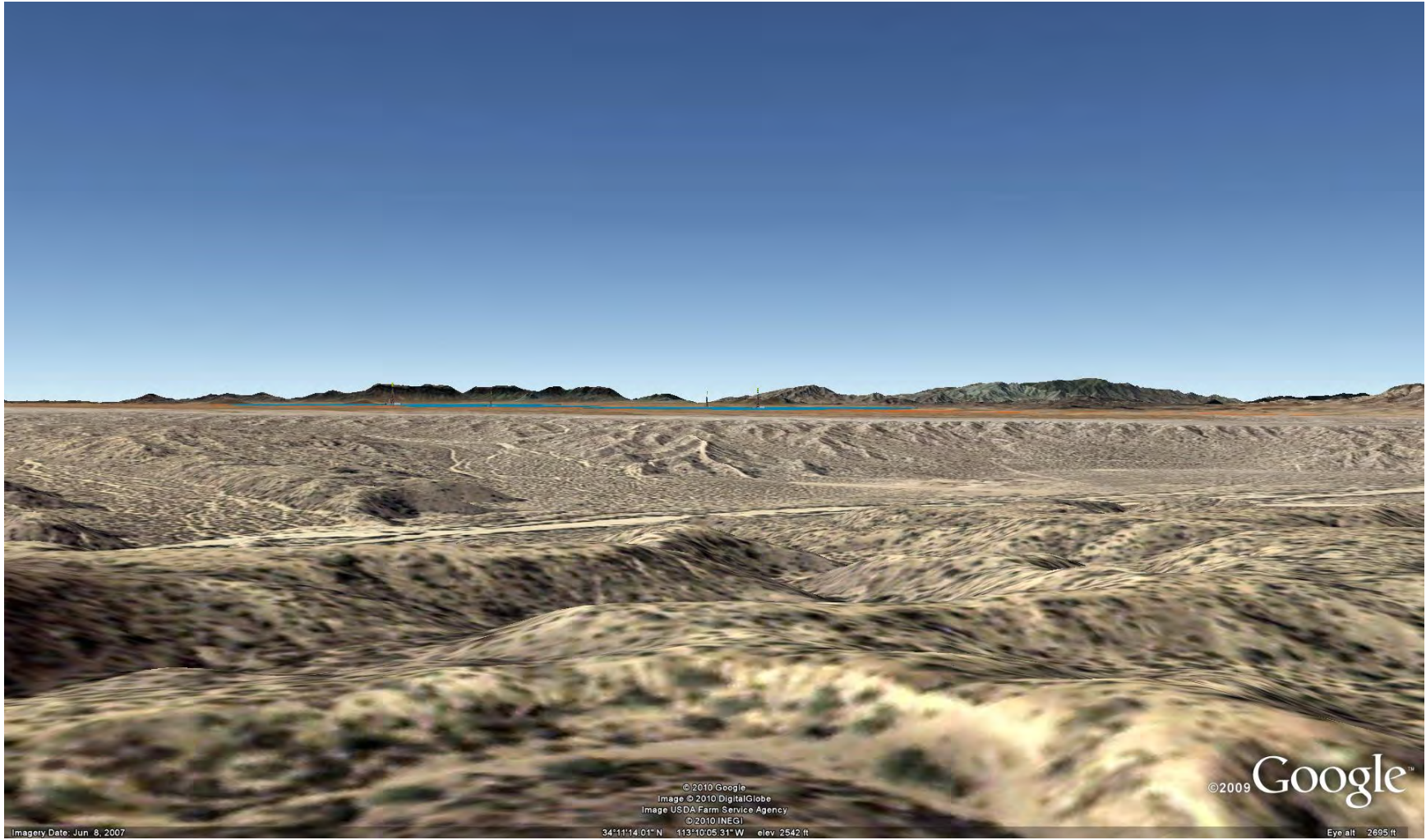
3
4 Figure 8.2.14.2-8 is a Google Earth visualization of the SEZ (highlighted in
5 orange) as seen from an unnamed hill in the southeastern portion of the WA,
6 4.2 mi (6.7 km) from the nearest point in the SEZ, on its northern boundary.
7 The viewpoint is elevated about 230 ft (70 m) above the nearest point in
8 the SEZ.

9
10 The visualization suggests that from this viewpoint, the SEZ would be viewed
11 across the shallow canyon containing Date Creek. Because of the short
12 distance to the SEZ, the SEZ would occupy much of the horizontal field of
13 view, but the vertical angle of view would be very low because of the small
14 elevation difference between the viewpoint and the SEZ. The SEZ and solar
15 facilities within it would be seen nearly edge-on and would tend to repeat the
16 line of the horizon, reducing visual contrast. The edge-on view would also
17 tend to reduce their apparent size and conceal their strong regular geometry,
18 as well as reduce visual contrast. However, taller ancillary facilities, such as
19 buildings, transmission structures, and cooling towers; and plumes (if present)
20 would likely be visible projecting above the collector/reflector arrays, and
21 their structural details could be evident at least for nearby facilities. The
22 ancillary facilities could create form and line contrasts with the strongly
23 horizontal, regular, and repeating forms and lines of the collector/reflector
24 arrays. Color and texture contrasts would also be likely, but their extent would
25 depend on the materials and surface treatments utilized in the facilities.

26
27 If power towers were present within the SEZ, the receivers would be visible
28 as very bright non-point light sources against a backdrop of the Harcuvar
29 Mountains south of the SEZ, or silhouetted against the sky in gaps between
30 the mountains. They would be expected to be visually prominent, and would
31 likely attract visual attention. The tower structures would likely be plainly
32 visible, adding short vertical line contrasts into the strongly horizontal
33 landscape. At night, if more than 200 ft (61 m) tall, power towers would have
34 navigation warning lights that could potentially be very conspicuous from this
35 location, given the dark night skies typical of this remote area. Other lighting
36 associated with solar facilities in the SEZ could be visible as well.

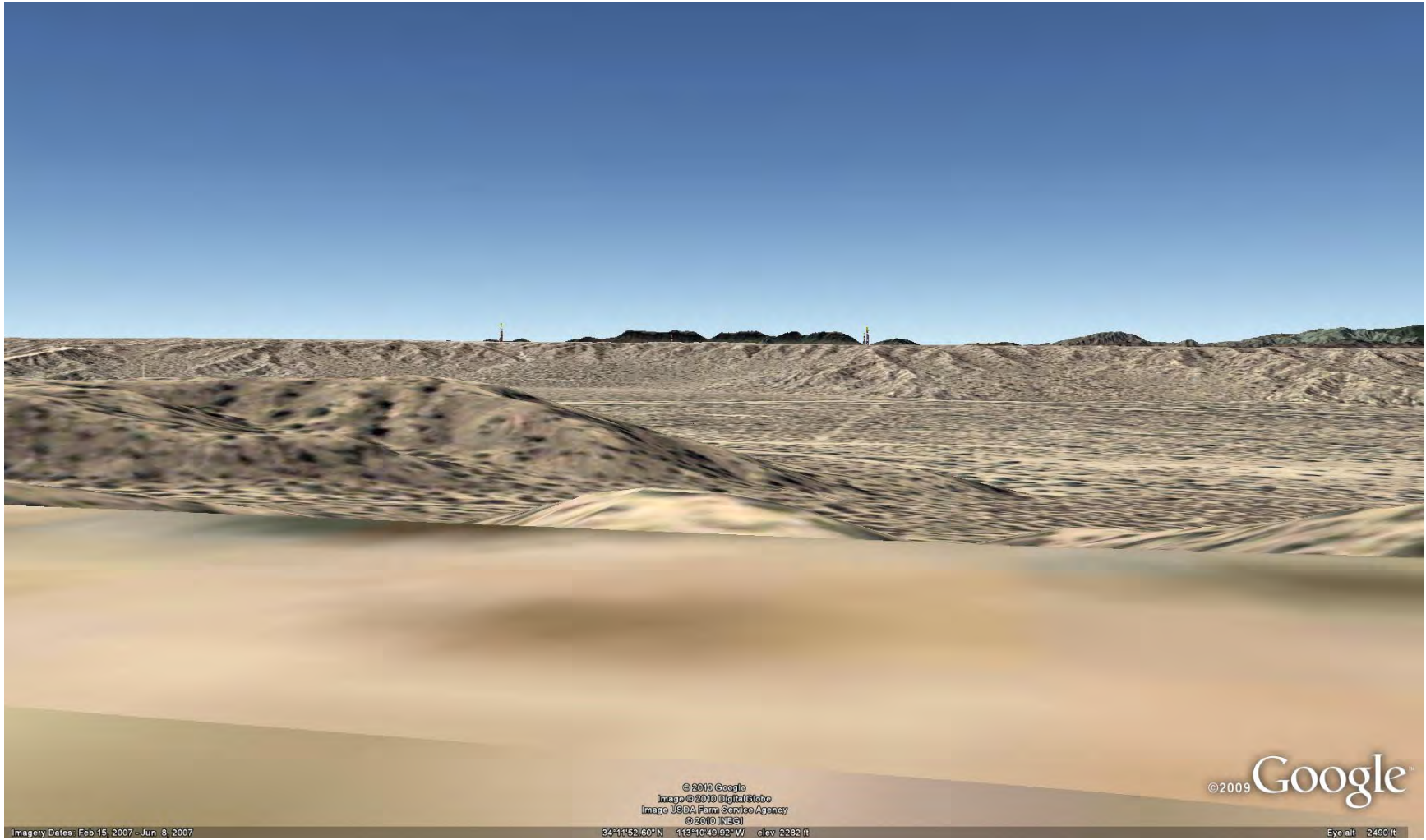
37
38 Potential visual contrast levels associated with solar development within the
39 SEZ would vary depending on the project-related and visibility factors noted
40 above, but under the 80% development scenario analyzed in the PEIS, strong
41 visual contrasts from solar energy development within the SEZ would be
42 expected at this viewpoint.

43
44 Figure 8.2.14.2-9 is a Google Earth visualization of the SEZ (highlighted in
45 orange) as seen from a low ridge in the southwestern portion of the WA,
46 3.9 mi (6.3 km) from the nearest point in the SEZ, on its northern boundary.



1

FIGURE 8.2.14.2-8 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from a Viewpoint within the Southeastern Portion of Tres Alamos WA



1

2 **FIGURE 8.2.14.2-9 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with**
3 **Power Tower Wireframe Models, as Seen from a Low Ridge within the Southwestern Portion of Tres Alamos WA**

4

5

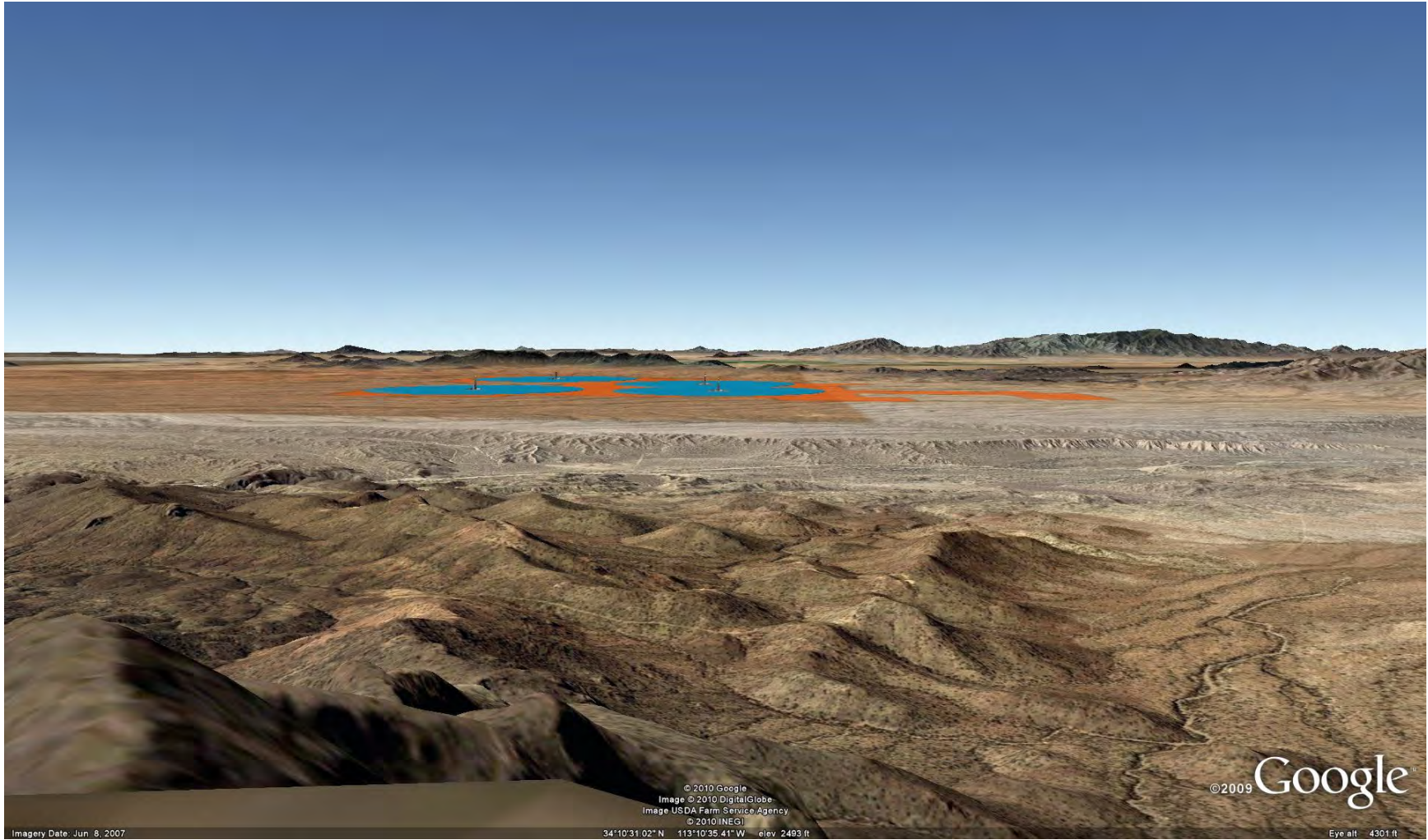
1 The viewpoint is elevated about 35 ft (11 m) above the nearest point in the
2 SEZ.

3
4 The visualization suggests that from this viewpoint, the SEZ would be viewed
5 across the shallow canyon containing Date Creek. Because the southern rim of
6 the canyon is slightly elevated with respect to both the viewpoint and the SEZ,
7 it would screen the SEZ entirely from view, but the upper portions of power
8 towers and possibly other tall structures and plumes associated with solar
9 facilities might be visible above the canyon rim. Because of the short distance
10 to the SEZ, these structures, if visible, could be spread across much of the
11 horizontal field of view. If power towers were present within the closest
12 portions of the SEZ, when operating the receivers would be visible as brilliant
13 white nonpoint light sources against a backdrop of the Harcuvar Mountains
14 south of the SEZ, or silhouetted against the sky in gaps between the
15 mountains. They would be expected to be visually prominent and would likely
16 attract visual attention. At night, if more than 200 ft (61 m) tall, power towers
17 would have navigation warning lights that could potentially be very
18 conspicuous from this location, given the dark night skies typical of this
19 remote area. Other lighting associated with solar facilities in the SEZ could be
20 visible as well.

21
22 Potential visual contrast levels associated with solar development within the
23 SEZ would vary depending on the project-related and visibility factors noted
24 above, but could vary quite widely. If sufficiently tall power towers or other
25 tall project components were absent from the northern portions of the SEZ,
26 there could be little or no visible impacts. If power tower receivers were
27 visible, visual contrasts would still vary widely, ranging from low contrast
28 levels during cloudy conditions or at other times when the facility was not
29 operating, to potentially high contrast levels if multiple towers were visible
30 in sunlit conditions. However, even this scenario would involve significantly
31 lower contrast levels than those expected if the full collector/reflector arrays
32 and ancillary facilities were visible.

33
34 Figure 8.2.14.2-10 is a Google Earth visualization of the SEZ (highlighted in
35 orange) as seen from the highest of the Tres Alamos mountains in the northern
36 portion of the WA, 6.5 mi (10.5 km) from the nearest point in the SEZ, on its
37 northern boundary. The viewpoint is elevated about 330 ft (100 m) above the
38 nearest point in the SEZ.

39
40 This viewpoint is much higher in elevation than the two viewpoints previously
41 described, but substantially farther from the SEZ. The SEZ would be viewed
42 across the shallow canyon containing Date Creek. The visualization suggests
43 that from this viewpoint, the vertical angle of view is high enough that the
44 entire SEZ would be visible, as would the tops of collector/reflector arrays of
45 solar facilities located within the SEZ. Compared to lower-angle views, this
46 elevated viewing angle would increase the apparent size of the SEZ and solar



1

2 **FIGURE 8.2.14.2-10 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with**
3 **Power Tower Wireframe Models, as Seen from a Mountain Peak within the Northern Portion of Tres Alamos WA**
4

1 facilities within the SEZ, and the strong regular geometry of the solar arrays
2 would be more apparent.

3
4 If power towers were present within the SEZ, the receivers would be visible
5 as bright to very bright non-point light sources against a backdrop of the floor
6 of the valley containing the SEZ. They would be expected to be visually
7 prominent and would likely attract visual attention when operating. Other
8 lighting associated with solar facilities could be visible as well.

9
10 Potential visual contrast levels associated with solar development within the
11 SEZ would vary depending on the project-related and visibility factors noted
12 above, but under the 80% development scenario analyzed in the PEIS, strong
13 visual contrasts from solar development within the SEZ would be expected at
14 this viewpoint.

15
16 In summary, the Tres Alamos WA is close enough to the SEZ that strong
17 visual contrasts resulting from solar development within the SEZ would be
18 expected for most viewpoints within the WA with a clear view of the SEZ.
19 Lower contrast levels would be expected at lower elevations, in part because
20 of lower viewing angles, but also (for some low-elevation viewpoints in the
21 WA) because of screening by landforms between the WA and the SEZ.

22 23 24 *Scenic Byways*

- 25
26 • *Joshua Forest Scenic Road (U.S. 93)*—Joshua Forest Scenic Road
27 (U.S. 93, and also referred to as the Joshua Tree Parkway) is a state- and
28 congressionally designated scenic byway that is 53 mi (86 km) long and
29 provides views of boulder fields, granite formations, and several creeks and
30 rivers. At the point of closest approach, the byway is within 5.5 mi (8.9 km) of
31 the northeast corner of the SEZ. Solar energy development within the Bullard
32 Wash SEZ would be visible from a portion of the Joshua Forest Scenic Road
33 mostly east and northeast of the northern portion of the SEZ, at distances
34 ranging from 5.5 mi (8.9 km) to 12 mi (19 km).

35
36 As shown in Figure 8.2.14.2-2, about 14 mi (22.5 km) of the road is within the
37 650-ft (198.1-m) viewshed of the SEZ. Elevations of the byway that are
38 within the viewshed of the SEZ are as much as 400 ft (122 m) higher than the
39 eastern portion of the SEZ.

40
41 For north-bound travelers on the Scenic Road, sufficiently tall power towers
42 at some locations within the SEZ could become visible about 10 mi (16 km)
43 northwest of the community of Wickenburg, AZ. At an approximate distance
44 of 12 mi (19 km) from the SEZ, the receivers of sufficiently tall operating
45 power towers could appear as bright points of light against a sky backdrop or
46 against a backdrop of the Harcuvar Mountains west of the SEZ and, if

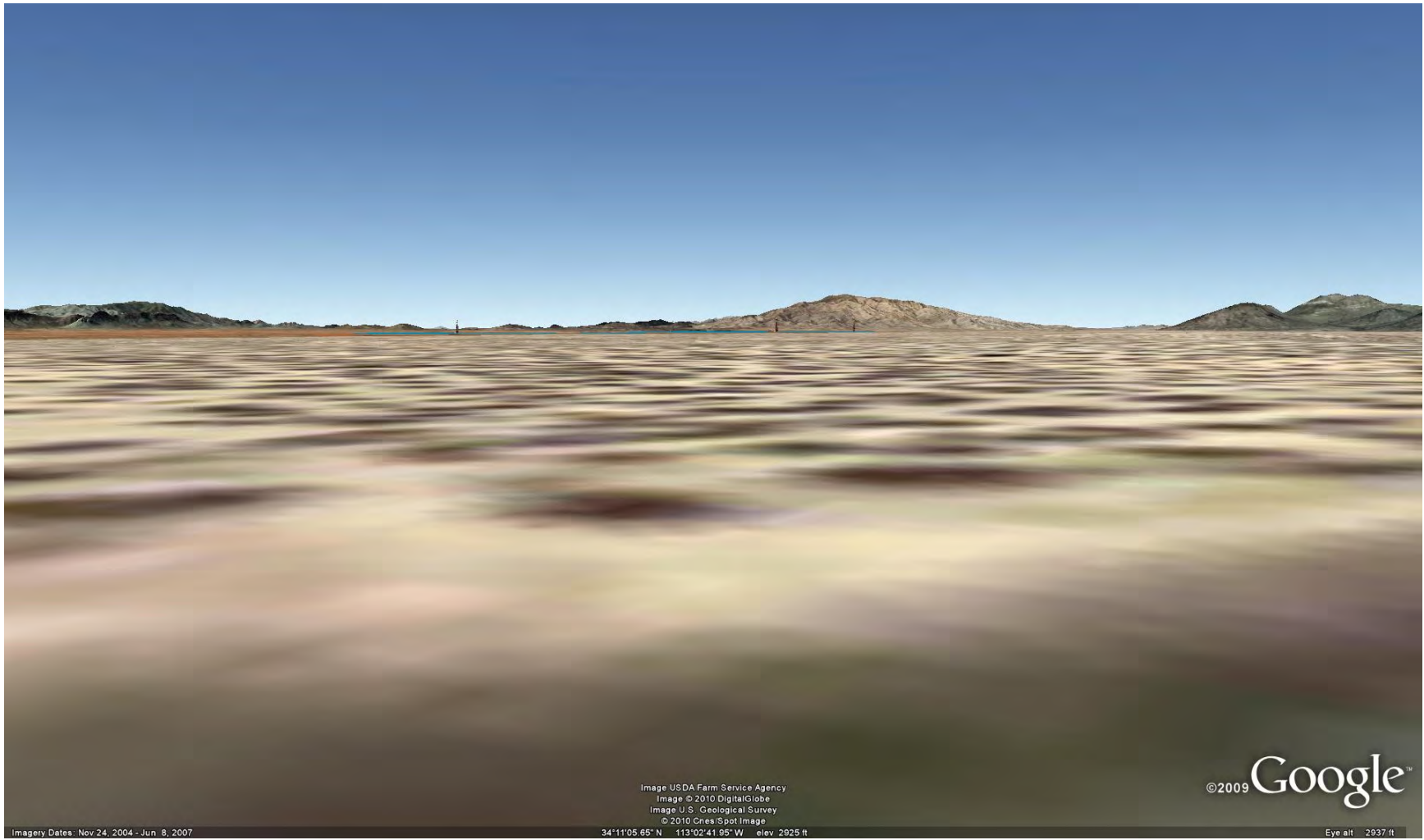
1 sufficiently tall to require hazard navigation lighting, likely would be visible
2 at night. The upper parts of the tower structures could be visible as well, but
3 the lower portions of the towers and the other facility components would be
4 screened by landform and vegetation. The receivers and visible portions of the
5 towers would be visible to the left (west) of northbound vehicles. Northbound
6 vehicles would have already passed the far southern portion of the SEZ when
7 any visible towers would first come into view, and at no point would the SEZ
8 be seen directly in front of vehicles on the Scenic Road.
9

10 In about 2 minutes (at highway speeds), as the road rises in elevation to the
11 northwest in the vicinity of the SEZ, lower-height solar facilities and
12 associated project components would come into view and gradually increase
13 in size as the road approached the SEZ. At about 9.7 mi (15.6 km) from the
14 SEZ (approximately 15 mi [23 km] from Wickenburg), parabolic trough and
15 PV arrays located in some portions of the SEZ might come into view briefly,
16 but after about 2 minutes they would disappear again because of topographic
17 screening. Partial screening of lower-height solar facilities within the SEZ
18 would then occur for the next several minutes, followed by brief periods of
19 total screening of solar facilities within the SEZ as the road passed through an
20 area of undulating terrain. The first brief period of full screening would occur
21 near the point of closest approach of the roadway to the SEZ (5.5 mi [8.9 km]
22 away, about 18.6 mi [29.9 km] northwest of Wickenburg). Views of the SEZ
23 would eventually be screened by the slopes of the Black Mountains at about
24 9.3 mi (15.0 km) from the SEZ, and about 28 mi (45 km) northwest of
25 Wickenburg.
26

27 Figure 8.2.14.2-11 is a Google Earth visualization of the SEZ (highlighted in
28 orange) as seen from the Joshua Forest Scenic Road near the point of closest
29 approach to the SEZ, 5.8 mi (9.3 km) from the northeast corner of the SEZ.
30 The viewpoint is elevated about 1,840 ft (561 m) above the nearest point in
31 the SEZ.
32

33 The visualization suggests that from this viewpoint, the SEZ would occupy
34 much of the horizontal field of view, but the vertical angle of view would be
35 very low because of the small elevation difference between the viewpoint and
36 the SEZ and because of partial screening of the SEZ by the sloping ground
37 between the road and the SEZ. The SEZ and solar facilities within it would
38 be seen nearly edge-on, which would tend to repeat the line of the horizon and
39 reduce visual contrast. The edge-on view would also tend to reduce their
40 apparent size and conceal their strong regular geometry. STGs, other power
41 block components, transmission components, cooling towers and plumes (for
42 parabolic trough and power tower facilities), and buildings (for all facility
43 types) could be visible above the collector/reflector arrays, however, at this
44 relatively short distance, their forms, lines, colors, and reflective surfaces
45 could create noticeable visual contrasts.
46

1



2

FIGURE 8.2.14.2-11 Google Earth Visualization of the Proposed Bullard Wash SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from a Viewpoint on the Joshua Forest Scenic Roadway

3

4

5

1 If power towers were present within the SEZ, the receivers would be visible as
2 very bright light sources against a backdrop of the Harcuvar Mountains south
3 of the SEZ, or silhouetted against the sky above the mountains. Operating
4 power towers could visually prominent and would likely attract visual
5 attention. The tower structures would likely be visible, adding short vertical
6 line contrasts into the strongly horizontal landscape. At night, if more than
7 200 ft (61 m) tall, power towers would have navigation warning lights that
8 could be conspicuous from this viewpoint.
9

10 Potential visual contrast levels associated with solar development within the
11 SEZ would vary depending on the project-related and visibility factors noted
12 above, but under the 80% development scenario analyzed in the PEIS,
13 moderately strong visual contrasts from solar energy development within
14 the SEZ would be expected at this viewpoint. However, at this viewpoint,
15 northbound vehicle occupants would need to look almost perpendicular to the
16 direction of travel to see the SEZ, and because travelers would be passing the
17 SEZ rather than approaching directly toward it, view duration would be
18 relatively brief.
19

20 Southbound travelers on the Joshua Tree Scenic Road would have a different
21 visual experience from northbound travelers. Southbound viewers would first
22 see the receivers of sufficiently tall power towers and other tall solar facility
23 components (if present in visible parts of the SEZ) at the far right of their
24 vehicles as they passed the southeast portion of the Black Mountains. An
25 extended period of potential visibility of solar facilities within the SEZ would
26 begin as southbound vehicles passed the point of closest approach of the
27 Scenic Road to the SEZ at 5.8 mi (9.3 km) from the northeast corner of the
28 SEZ, but at this point vehicles would have passed the northwestern half of the
29 SEZ and their vehicles would actually be pointed southeast, away from the
30 SEZ. Very quickly, vehicle occupants would need to look behind and to the
31 right of their vehicles to see the SEZ, which would tend to reduce the
32 frequency and duration of viewing the SEZ. Therefore, in general, southbound
33 travelers on the Scenic Roadway would be subject to lower levels of visual
34 impact for solar energy development within the SEZ than northbound
35 travelers.
36
37

38 *ACEC Designated for Outstandingly Remarkable Scenic Values*

39

- 40 • *Three Rivers Riparian*—The 87,716-acre (355-km²) Three Rivers Riparian
41 ACEC is about 12 mi (19 km) northwest of the SEZ at the closest point of
42 approach. Within the ACEC, the Big Sandy, Santa Maria, and Bill Williams
43 Rivers are free-flowing and have outstanding scenic qualities, including
44 riparian vegetation, surrounding mountains and cliff features, and largely
45 undeveloped shorelines uncluttered by human activity (BLM 1993).
46 Approximately 3,981 acres (16 km²), or 5% of the ACEC, is within the 650-ft

1 (198.1-m) viewshed of the SEZ, and 473 acres (2 km²), or 0.5% of the total
2 ACEC acreage is in the 24.6-ft (7.5-m) viewshed. As shown in Figure
3 8.2.14.2-2, the visible area of the ACEC extends to beyond 25 mi (40 km)
4 from the northwestern boundary of the SEZ.
5

6 Some small, scattered areas at higher elevations within the ACEC are within
7 the SEZ viewshed, although from most of these locations only taller solar
8 facility components (such as power towers) would be visible. In four very
9 small areas totaling about 473 acres (1.9 km²), low-height collector/reflector
10 arrays (such as parabolic trough mirrors and PV panels) could be visible.
11 These areas are primarily in the far western portions of the ACEC. In most
12 of these areas, the distances to the SEZ (22 to 25 mi [35 to 40 km]) are great
13 enough and the angle of view low enough that visual contrasts from solar
14 energy development would be expected to be minimal. However, contrasts
15 would possibly increase to weak levels in the areas with the clearest views of
16 the SEZ. Where operating power tower receivers within the SEZ were visible,
17 they likely would appear as distant points of light silhouetted against the sky
18 on the southwest horizon and, if tall enough to require navigation hazard
19 lighting, could potentially be visible at night as well.
20

21 Along the northern and southern boundaries of the eastern portion of the
22 ACEC are three very small areas of visibility, each containing several parcels,
23 with each parcel less than 50 acres (0.20 km²) in size. From these parcels,
24 lower-height solar facilities within a part of the SEZ could be visible.
25 However, the angle of view would be very low, so that collector/reflector
26 arrays within the SEZ would be viewed edge-on or nearly so, thus greatly
27 reducing their apparent size and repeating the strong horizontal line of the
28 horizon. This would tend to reduce visual contrast. At distances ranging from
29 12 to 14 mi (19 to 23 km), the SEZ would occupy a large enough portion of
30 the horizontal field of view that expected visual contrast levels could reach
31 weak levels.
32

33 In summary, solar energy development within the SEZ would not be visible
34 from most of the ACEC. The receivers of power towers within the SEZ could
35 be visible from small, scattered locations at higher elevations within the
36 ACEC, with visual contrast levels associated with solar development within
37 the SEZ expected to range from minimal to weak. From a few very small and
38 scattered parcels of land within the ACEC lower height solar facilities within
39 the SEZ might be visible, with visual contrast expected to be weak.
40

- 41 • *Poachie Desert Tortoise*—The 33,512-acre (136-km²) Poachie Desert
42 Tortoise ACEC is 21 mi (34 km) northwest of the SEZ at the closest point.
43 The Poachie Mountains are small, desert mountains with rugged boulder-
44 strewn slopes rising above the surrounding bajadas. Very few roads enter the
45 area. The environment of unique vegetation, jumbled granitic boulder piles
46 that dominate the area, and limited vehicle access offers visitors both scenic

1 views and backcountry recreation opportunities (BLM 1993). About
2 1,714 acres (7 km²), or 5% of the ACEC, is within the 650-ft (198.1-m)
3 viewshed of the SEZ, and 668 acres (2.7 km²), or 2% of the total ACEC
4 acreage, is in the 24.6-ft (7.5-m) viewshed. The visible area of the ACEC
5 extends to beyond 25 mi (40 km) from the northern boundary of the SEZ.
6

7 Some small, scattered areas at higher elevations within the Poachie Desert
8 Tortoise ACEC are within the SEZ viewshed, although from most of these
9 locations only taller solar facility components, such as power towers, would
10 be visible. SEZ visibility is confined to two general areas: higher elevations
11 within and near Poachie Ridge in the southwestern portion of the ACEC, and
12 scattered hilltops in the far western portion of the ACEC. In these areas, the
13 distances to the SEZ (21 to 25 mi [34 to 40 km]) are great enough, and the
14 angle of view is low enough, that visual contrasts from solar energy
15 development would be expected to range from minimal to weak in the areas
16 with the clearest views of the SEZ. Where operating power tower receivers
17 within the SEZ were visible, they would likely appear as distant points of light
18 silhouetted against the sky on the southern horizon during the day and, if more
19 than 200 ft (61 m) tall, would have navigation warning lights at night that
20 could be visible from the ACEC.
21

- 22 • *Harquahala Mountains*—The 77,201-acre (312-km²) Harquahala Mountains
23 ACEC is located 14.5 mi (23 km) southwest of the SEZ at the closest point.
24 The Bradshaw-Harquahala Approved RMP and FEIS and the associated ROD
25 (BLM 2010b) state that long-term conservation of scenic, natural resource,
26 and cultural values is a management goal for the ACEC. Approximately
27 16,192 acres (66 km²), or 21% of the ACEC, is within the 650-ft (198.1-m)
28 viewshed of the SEZ, and 2,302 acres (9.3 km²), or 3% of the total ACEC
29 acreage, is in the 24.6-ft (7.5-m) viewshed. The visible area of the ACEC
30 extends approximately 25 mi (40 km) from the southern boundary of the SEZ.
31

32 As shown in Figure 8.2.14.2-2, within the ACEC, areas in the 25-mi (40-km)
33 viewshed of the SEZ are limited primarily to the northeast-facing ridges on
34 the northwest sides of the Harcuvar Mountains, southwest of the SEZ. Solar
35 development within the SEZ could also be visible from an area just southwest
36 of Eagle Eye Mountain, including a very small area with limited visibility on
37 the southeastern side of the Harcuvar Mountains.
38

39 Figure 8.2.14.2-6 (see above under Harquahala Mountain WA discussion) is
40 a Google Earth visualization of the SEZ (highlighted in orange) as seen from
41 an unnamed peak on the boundary of the Harquahala Mountain WA and the
42 ACEC, about 16 mi (26 km) from the southernmost boundary of the SEZ. The
43 viewpoint is elevated about 2,100 ft (640 m) above the nearest point in the
44 SEZ. This viewpoint is very near the highest elevation within the ACEC that
45 is also within the SEZ viewshed, and even though it is not the closest point in
46 the ACEC within the SEZ viewshed, because it has the least obstructed view

1 of the SEZ and the highest vertical angle of view to the SEZ, it is at or very
2 close to the point of greatest potential visual impact from solar development
3 within the SEZ.

4
5 The visualization suggests that from this viewpoint, the SEZ would be viewed
6 across a wide plain containing a large array of rectangular agricultural fields,
7 just beyond the far eastern arm of the Harcuvar Mountains, which would
8 screen some portions of the SEZ from view. Because of the long distance to
9 the SEZ, the SEZ would occupy a small portion of the field of view. Within
10 the visible portion of the SEZ, the tops of collector arrays within the SEZ
11 might be visible, but the angle of view would be low because of the distance
12 to the SEZ. The SEZ and solar facilities within it would be seen as a narrow
13 band just over the tops of the mountains between the viewpoint and the SEZ,
14 and the facilities would tend to repeat the line of the valley floor in which the
15 SEZ is located, thus reducing visual contrast.

16
17 If power towers were present within the SEZ, they would be visible as distant
18 star-like points of light against a backdrop of the Bullard Wash floor. At night,
19 if more than 200 ft (61 m) tall, the power towers would have navigation
20 warning lights that could be visible from this location.

21
22 Potential visual contrast levels associated with solar development within the
23 SEZ would vary depending on the project-related and visibility factors noted
24 above, but under the 80% development scenario analyzed in the PEIS, weak
25 visual contrasts from solar energy development within the SEZ would be
26 expected at this viewpoint.

27
28 Other viewpoints within the ACEC that are closer to the SEZ than the
29 viewpoint discussed above and shown in Figure 8.2.14.2-6 are necessarily at
30 lower elevations, and because of topographic screening, views of the SEZ
31 would be more obstructed. These locations also have lower vertical angles of
32 view and would therefore be expected to have visual contrast levels generally
33 ranging from minimal to weak. Other viewpoints within the ACEC that are
34 farther from the SEZ than the viewpoint discussed above and shown in
35 Figure 8.2.14.2-6 also are necessarily at lower elevations and therefore would
36 have more obstructed views of the SEZ because of topographic screening.
37 Because they are also farther from the SEZ, the apparent height and size of
38 solar facilities within the SEZ would be smaller, and reflected light and color
39 intensity of facility components would be further reduced, so that expected
40 contrast levels would be minimal.

41
42 In summary, solar energy development within the SEZ would cause the
43 highest levels of visual contrast for viewpoints at high elevations within the
44 northeastern portion of the ACEC; but primarily because of the distances
45 involved, the low viewing angles, and partial topographic screening, under the
46 80% development scenario analyzed in the PEIS, visual contrast levels from

1 solar energy facilities within the SEZ would be expected to be weak. For
2 viewpoints at lower elevations within the ACEC, regardless of the distance
3 from the SEZ, expected visual contrast would be minimal to weak.
4

- 5 • *Black Butte*—The 9,549-acre (39-km²) Black Butte ACEC is located 17 mi
6 (27 km) southeast of the SEZ at the closest point of approach. The Bradshaw-
7 Harquahala Approved RMP and FEIS and the associated ROD (BLM 2010b)
8 state that the cliffs at the crest of Black Butte are a pristine, scenic landmark.
9 The RMP states the importance of minimizing visual intrusions associated
10 with any management activity so as to preserve the outstanding scenic quality
11 and natural landscape appearance.
12

13 About 422 acres (2 km²), or 4% of the ACEC, is within the 650-ft (198.1-m)
14 viewshed of the SEZ, and 44 acres (0.2 km²), or 0.5% of the total ACEC
15 acreage, is in the 24.6-ft (7.5-m) viewshed. The visible area of the ACEC
16 extends to about 20 mi (32 km) from the southern boundary of the SEZ.
17

18 Areas within the 25-mi (40-km) viewshed of the SEZ are limited to the
19 vicinity of the peak of Black Butte and the highest points on the ridge south-
20 southwest of Black Butte. Collector/reflector arrays for lower-height solar
21 facilities could be visible from about 44 acres at the peak of Black Butte, but
22 the Harcuvar Mountains immediately south of the SEZ would screen most of
23 the SEZ from view from this area. Therefore, only a very small portion of the
24 SEZ would be visible within a notch between two peaks in the Harcuvar
25 Mountains north of the ACEC. If operating power tower receivers within
26 the SEZ were visible from this area, they would appear as points of light
27 just above the gap in the Harcuvar Mountains. At night, if more than 200 ft
28 (61 m) tall, the power towers would have navigation warning lights that could
29 be visible from the ACEC. Expected visual contrast levels would be minimal
30 to weak.
31

32 From viewpoints elsewhere within the ACEC, visible solar energy facilities
33 would be limited to taller solar facility components, which if located in very
34 specific locations within the SEZ, might be just visible within notches in the
35 Harcuvar Mountains. Expected visual contrast levels for viewpoints on Black
36 Butte would be minimal to weak, and visual contrasts seen from the ridgetops
37 southwest of Black Butte would be expected to be minimal, because of the
38 increased distance to the SEZ.
39

40 Additional scenic resources exist at the national, state, and local levels, and impacts may
41 occur on both federal and nonfederal lands, including sensitive traditional cultural properties
42 important to Tribes. Note that in addition to the resource types and specific resources analyzed
43 in this PEIS, future site-specific NEPA analyses would include state and local parks, recreation
44 areas, other sensitive visual resources, and communities close enough to the proposed project to
45 be affected by visual impacts. Selected other lands and resources are included in the discussion
46 below.
47

1 In addition to impacts associated with the solar energy facilities themselves, sensitive
2 visual resources could be affected by other facilities that would be built and operated in
3 conjunction with the solar facilities. With respect to visual impacts, the most important
4 associated facilities would be access roads and transmission lines, the precise location of which
5 cannot be determined until a specific solar energy project is proposed. There is no suitable
6 transmission line within the proposed SEZ, so construction and operation of a transmission line
7 outside the proposed SEZ would be required, and construction of transmission lines within the
8 SEZ to connect facilities to the main line would be required as well. Note that depending on
9 project- and site-specific conditions, visual impacts associated with access roads, and particularly
10 transmission lines, could be large. Detailed information about visual impacts associated with
11 transmission lines is presented in Section 5.7.1. A detailed site-specific NEPA analysis would be
12 required to determine visibility and associated impacts precisely for any future solar projects,
13 based on more precise knowledge of facility location and characteristics.
14

15 **Impacts on Selected Nonfederal Lands and Resources**

16
17
18

19 *Towns of Aguila and Congress.* The viewshed analyses indicate visibility of the SEZ
20 from the towns of Aguila (about 10 mi [16 km] south of the SEZ) and Congress (about 16 mi
21 [26 km] east of the SEZ).
22

23 The viewshed analysis indicates that within the community of Aguila, where local
24 buildings or vegetation did not screen views toward the SEZ, the upper portions of power tower
25 facilities could potentially be visible in gaps within the line of low mountains at the far eastern
26 end of the Harcuvar Mountains. Lower-height solar facilities in the SEZ would be completely
27 screened by the mountains. At distances exceeding 11 mi (18 km), the receivers of power towers
28 within the SEZ could appear as bright points of light appearing just over the mountains;
29 however, it is unlikely that more than one power tower receiver would be visible from any given
30 location. In addition, vegetation within the community and north of the community might screen
31 views of the power towers from some locations. Visibility of power towers would be somewhat
32 greater in the agricultural fields west of the urban center of Aguila. At night, if more than 200 ft
33 (61 m) tall, power towers would have navigation warning lights that could potentially be visible
34 from Aguila as well. Potential visual contrast levels associated with solar development within the
35 SEZ would vary depending on the project-related and visibility factors noted above, but under
36 the 80% development scenario analyzed in the PEIS, weak visual contrasts from solar energy
37 development within the SEZ would be expected for viewpoints within the Aguila area.
38

39 The viewshed analysis indicates that within the community of Congress, where local
40 buildings or vegetation did not screen views toward the SEZ, the upper portions of sufficiently
41 tall power tower facilities could potentially be visible. Congress is at the extreme limit of
42 visibility within the 650-ft (198.1-m) viewshed of the SEZ, however, so if power towers were tall
43 enough to be seen at all, the receiver lights would appear just at the horizon and would likely be
44 difficult to see under most circumstances. If they were visible, the receiver lights would appear
45 as distant point light sources just at the western horizon. Expected visual contrast levels would be
46 minimal.
47

1 Regardless of visibility from Aguila and Congress, residents, workers, and visitors to
2 the area would likely experience visual impacts from solar energy facilities located within the
3 SEZ (as well as any associated access roads and transmission lines) as they travel area roads,
4 including U.S. 60, State Route 71, U.S. 93, and Alamo Road, an unpaved road providing
5 access to the northern boundary of the SEZ. The range of impacts experienced would be
6 highly dependent on viewer location, project types, locations, sizes, and layouts, as well as
7 the presence of screening, but under the 80% development scenario analyzed in this PEIS,
8 from some locations, strong visual contrasts from solar facilities within the SEZ could
9 potentially be observed.

10
11
12 **U.S. 60.** U.S. 60, a two-lane highway, passes within 10 mi (16 km) south of the Bullard
13 Wash SEZ. The AADT value for U.S. 60 in the vicinity of the SEZ was about 1,600 vehicles
14 in 2008, the latest year for which figures are available (ADOT 2010a), although traffic could
15 increase slightly as a result of solar energy development within the SEZ. About 31 mi (50 km)
16 of U.S. 60 is within the SEZ 650-ft (198.1-m) viewshed, but only about 5.5 mi (8.9 km) is
17 within the 24.6-ft (7.5-m) viewshed, along a stretch of the roadway southeast of the SEZ, about
18 midway between Aguila and Wickenburg, and between 13 to 17 mi (21 to 27 km) from the SEZ.
19 Elevation of the roadway in this stretch varies from about 300 ft (90 m) higher than the lowest
20 point in the SEZ to about the same elevation as the highest point within the SEZ. For almost the
21 entire remainder of the roadway within the viewshed, visibility of solar facilities within the SEZ
22 would be limited to the upper portions of sufficiently tall power towers, at distances ranging
23 from about 10 mi (16 km) to beyond 25 mi (40 km) from the SEZ.

24
25 Low-height solar facilities within the SEZ would be in view from U.S. 60 for about
26 5 minutes as travelers approached from either direction. During this time, if solar facilities within
27 the SEZ were visible, they would be seen behind and to the left of eastbound vehicles, and
28 roughly 45 degrees north of the direction of travel for westbound vehicles. Because of the
29 minimal elevation difference between the roadway and the SEZ, and the 12- to 16-mi (21- to
30 27-km) distance from the roadway to the SEZ in this stretch of the road, the SEZ would occupy
31 a very small portion of the horizontal angle of view, and the angle of view would be very low,
32 tending to decrease the visual contrast from solar facilities within the SEZ. Sufficiently tall
33 operating power towers located within the SEZ could project beyond the mountain backdrop to
34 be viewed against the sky. At night, if more than 200 ft (61 m) tall, power towers would have
35 navigation warning lights that could be visible from U.S. 60. Under the PEIS development
36 scenario, solar energy facilities within the SEZ would be expected to cause weak visual contrasts
37 for travelers on U.S. 60. For those portions of U.S. 60 where only the upper portions of power
38 towers within the SEZ could be visible, solar energy facilities within the SEZ would be expected
39 to cause minimal to weak visual contrasts for travelers on U.S. 60.

40
41
42 **State Route 71.** About 15mi (24 km) of State Route 71 passes through the 650-ft
43 (198.1-m) viewshed of the SEZ, but only 0.3 mi (0.5 km) is within the 24.6-ft (7.5-m) viewshed.
44 The AADT value for State Route 71 in the vicinity of the SEZ was between 600 and 800
45 vehicles in 2008, the latest year for which figures are available (ADOT 2010a). State Route 71
46 passes through the viewshed of the SEZ in three separate areas, as follows (east to west):
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- *Road segment starting in the community of Congress and extending west for 7.8 mi (12.6 km).* Visibility of solar facilities within the SEZ from the roadway in this segment would be limited to the upper parts of taller power towers in some portions of the roadway, but could include lower power towers and transmission towers/lines in some other portions. Elevations in this stretch of the roadway exceed the highest elevation in the SEZ by about 150 to 470 ft (46 to 143 m), and the distance to the SEZ ranges from 9.7 to 17 mi (15.6 to 27.4 km). Sufficiently tall operating power towers located within the SEZ could project beyond the mountain backdrop to be viewed against the sky, but the SEZ would occupy a very small portion of the horizontal field of view. At night, if more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from State Route 71. Under the PEIS development scenario, solar energy facilities within the SEZ would be expected to cause minimal to weak visual contrasts for travelers on this segment of State Route 71.
- 17
- *Road segment starting just southwest of Merritt Pass and extending southwest for 6.6 mi (11 km).* Within the first 0.3 mi (0.5 km) of this segment, low-height solar facilities within the SEZ could be visible almost perpendicular to the direction of travel for about 20 seconds at highway speeds. For most of the remainder of the segment, only power towers and transmission towers/lines could be visible. Taller facilities located within the SEZ could be visible for several minutes. Elevation of the roadway in this stretch varies from about 100 ft (30 m) higher than the lowest point in the SEZ to about 70 ft (21 m) higher than the highest point within the SEZ, and the distance to the SEZ ranges from 4.9 to 7.8 mi (7.9 to 12.6 km). From this segment, topographic screening would conceal some of the SEZ from view. Operating power towers within the SEZ could be seen against the mountain backdrop west of the SEZ, or might project beyond the mountain backdrop to be viewed against the sky, but the SEZ would occupy only a small portion of the horizontal field of view. The lights could be very bright at the short distances involved and, if more than 200 ft (61 m) tall, would have navigation warning lights that could potentially be conspicuous from this segment of the roadway. The tower structures (and potentially transmission towers and other taller structures) could be visible. Under the PEIS development scenario, solar energy facilities within the SEZ would be expected to cause weak visual contrasts for travelers on this segment of State Route 71.
- 38
- *Very short road segment near the southwestern end of State Route 71 at and near Aguila.* Within this 2.5-mi (4-km) segment of State Route 71, the upper portions of sufficiently tall power towers located in the far western portion of the SEZ could be visible at a distance of about 13 mi (21 km). Views of the SEZ would be brief and the direction of view toward the SEZ would be nearly perpendicular to the line of travel for most of the segment. The receivers of sufficiently tall power towers within the far western portion of the SEZ might be visible as points of light within gaps in the Harcuvar Mountains south of
- 46

1 the SEZ. At night, if more than 200 ft (61 m) tall, power towers would have
2 navigation warning lights that could potentially be visible from this segment
3 of the roadway. Under the PEIS development scenario, solar energy facilities
4 within the SEZ would be expected to cause minimal to weak visual contrasts
5 for travelers on this segment of State Route 71.
6
7

8 **8.2.14.2.3 Summary of Visual Resource Impacts for the Proposed Bullard Wash SEZ** 9

10 The proposed Bullard Wash SEZ is in an area of low scenic quality, though generally free
11 of cultural disturbances. Because under the 80% development scenario analyzed in this PEIS
12 there could be numerous solar facilities within the SEZ, a variety of technologies employed, and
13 a range of supporting facilities that would contribute to visual impacts, a visually complex, man-
14 made appearing industrial landscape could result. This essentially industrial-appearing landscape
15 would contrast greatly with the surrounding generally natural-appearing lands. Large visual
16 impacts on the SEZ and surrounding lands within the SEZ viewshed would be associated with
17 solar energy development within the SEZ due to major modification of the character of the
18 existing landscape. There would be additional impacts from construction and operation of
19 transmission lines and access roads within and outside the SEZ.
20

21 Under the 80% development scenario analyzed in the PEIS, utility-scale solar energy
22 development within the proposed Bullard Wash SEZ is likely to result in weak to strong visual
23 contrasts for some viewpoints within the Tres Alamos WA, which is 3.5 mi (5.6 km) from the
24 SEZ at the point of closest approach. Weak to moderate visual contrasts would be expected for
25 some viewpoints within the Arrastra Mountain WA, which is within 8.6 mi (13.8 km) of the SEZ
26 at the point of closest approach. Minimal to weak visual contrasts would be expected for some
27 viewpoints within other sensitive visual resource areas within the SEZ 25-mi (40 km) viewshed.
28

29 Joshua Forest Scenic Road passes within 5.5 mi (8.9 km) of the SEZ and is in the
30 viewshed of the SEZ for about 14 mi (22.5 km). Because of the proximity of Joshua Forest
31 Scenic Road to the SEZ, moderate to strong visual contrasts could be observed by road users.
32 Residents of nearby areas, workers, and visitors to the area may experience visual impacts from
33 solar energy facilities located within the SEZ (as well as any associated access roads and
34 transmission lines) as they travel other area roads.
35
36

37 **8.2.14.3 SEZ-Specific Design Features and Design Feature Effectiveness** 38

39 No SEZ-specific design features have been identified to protect visual resources for the
40 proposed Bullard Wash SEZ. As noted in Section 8.2.14.2, the Tres Alamos WA is 3.5 mi
41 (5.6 km) away at the point of closest approach north of the SEZ and is within the SEZ viewshed.
42 Some portions of the WA within the SEZ viewshed would have clear views of the SEZ at a
43 distance within the BLM VRM program's foreground-middleground distance, and could
44 therefore be subject to strong visual contrasts from solar facilities within the SEZ. However,
45 wilderness visitation is estimated at less than 200 visits annually and is not expected to increase

1 significantly in the foreseeable future, so SEZ-specific design features would not be warranted
2 for the very small number of potential viewers.
3

4 As noted in Section 5.12, the presence and operation of large-scale solar energy facilities
5 and equipment would introduce major visual changes into non-industrialized landscapes and
6 could create strong visual contrasts in line, form, color, and texture that could not easily be
7 mitigated substantially. Implementation of the programmatic design features presented in
8 Appendix A, Section A.2.2, would be expected to reduce the magnitude of visual impacts
9 experienced; however, the degree of effectiveness of these design features could be assessed
10 only at the site- and project-specific level. Given the large scale, reflective surfaces, and strong
11 regular geometry of utility-scale solar energy facilities and the typical lack of screening
12 vegetation and landforms within the SEZ viewshed, siting the facilities away from sensitive
13 visual resource areas and other sensitive viewing areas is the primary means of mitigating
14 visual impacts. The effectiveness of other visual impact mitigation measures would generally
15 be limited.
16
17

1 **8.2.15 Acoustic Environment**

2
3
4 **8.2.15.1 Affected Environment**

5
6 The proposed Bullard Wash SEZ is located in near central Arizona, in the southwest
7 corner of Yavapai County. Neither the State of Arizona nor Yavapai County has established
8 quantitative noise-limit regulations applicable to solar energy development.
9

10 State Route 71 runs southwest–northeast as close as 5 mi (8 km) to the southeast. U.S. 93
11 runs northwest–southeast as close as about 5.5 mi (8.8 km) to the northeast, while U.S. 60 runs
12 east–west as close as about 10 mi (16 km) to the south of the proposed Bullard Wash SEZ. There
13 is an access road to the north side of the SEZ, and several low-quality dirt roads enter the areas.
14 The nearest railroads run about 9 mi (14.5 km) south of the SEZ and about 15 mi (24 km) to the
15 east. Nearby airports include Flying Dare’s Ranch, Eagle Roost, and Forepaugh, which are
16 located about 6 mi (10 km) south–southwest, 11 mi (18 km) south, and 12 mi (19 km) southeast
17 of the SEZ, respectively. Wickenburg Municipal Airport is located about 21 mi (34 km) east–
18 southeast of the SEZ. No industrial activities except traditionally heavy grazing are located
19 around the SEZ, and water development (windmill) occurs on private land to the west. Large-
20 scale irrigated agricultural lands are developed around Aguila, about 7 mi (11 km) to the south.
21 No sensitive receptors (e.g., residences, hospitals, schools, or nursing homes) exist around the
22 proposed Bullard Wash SEZ. The nearest receptors are located about 5.6 mi (9.0 km) south–
23 southwest of the SEZ. The nearest population center with schools is Aguila in Maricopa County,
24 about 10 mi (16 km) south of the SEZ. Accordingly, noise sources around the SEZ include road
25 traffic, railroad traffic, infrequent private/commercial and frequent military aircraft flyover, and
26 cattle grazing. The proposed Bullard Wash SEZ is isolated and mostly undeveloped, the overall
27 character of which is considered as rural. To date, no environmental noise survey has been
28 conducted around the proposed Bullard Wash SEZ. On the basis of the population density, the
29 day-night average noise level (L_{dn} or DNL) is estimated to be 35 dBA for Yavapai County, in
30 the low end of the range of 33 to 47 dBA L_{dn} typical of a rural area (Eldred 1982;
31 Miller 2002).¹¹
32
33

34 **8.2.15.2 Impacts**

35
36 Potential noise impacts associated with solar projects in the Bullard Wash SEZ would
37 occur during all phases of the projects. During the construction phase, potential noise impacts
38 associated with the operation of heavy equipment and vehicular traffic on the nearest residences
39 (about 5.6 mi [9.0 km] to the south–southwest of the SEZ boundary) would not be anticipated,
40 due to considerable separation distances. During the operations phase, potential minor impacts
41 on the nearest residences would be anticipated, depending on the solar technologies employed.
42 Noise impacts shared by all solar technologies are discussed in detail in Section 5.13.1, and

¹¹ Rural and undeveloped areas have sound levels in the range of 33 to 47 dBA as L_{dn} (Eldred 1982). Typically, the nighttime level is 10 dBA lower than the daytime level, and it can be interpreted as 33 to 47 dBA (mean 40 dBA) during daytime hours and 23 to 37 dBA (mean 30 dBA) during nighttime hours.

1 technology-specific impacts are presented in Section 5.13.2. Impacts specific to the proposed
2 Bullard Wash SEZ are presented in this section. Any such impacts would be minimized through
3 the implementation of required programmatic design features described in Appendix A,
4 Section A.2.2 and the application of any additional SEZ-specific design features (see
5 Section 8.2.15.3, below). This section primarily addresses noise impacts on human beings only,
6 although impacts on wildlife at nearby sensitive areas are discussed. Additional discussion on
7 potential noise impacts on wildlife is presented in Section 5.10.2.
8
9

10 **8.2.15.2.1 Construction**

11
12 The proposed Bullard Wash SEZ has a relatively flat terrain; thus, minimal site
13 preparation activities would be required, and associated noise levels would be lower than
14 those during general construction (e.g., erecting building structures and installing equipment,
15 piping, and electrical).
16

17 For the parabolic trough and power tower technologies, the highest construction noise
18 levels would occur at the power block area where key components (e.g., steam turbine/generator)
19 needed to generate electricity are located; a maximum of 95 dBA at a distance of 50 ft (15 m) is
20 assumed, if impact equipment such as pile drivers or rock drills are not being used. Typically, the
21 power block area is located in the center of the solar facility, at a distance of more than 0.5 mi
22 (0.8 km) from the facility boundary. Noise levels from construction of the solar array would be
23 lower than 95 dBA. When geometric spreading and ground effects are considered, as explained
24 in Section 4.13.1, noise levels would attenuate to about 40 dBA at a distance of 1.2 mi (1.9 km)
25 from the power block area. This noise level is typical of daytime mean rural background level.
26 In addition, mid- and high-frequency noise from construction activities is significantly
27 attenuated by atmospheric absorption under the low-humidity conditions typical of an arid desert
28 environment and by temperature lapse conditions typical of daytime hours; thus noise attenuation
29 to a 40-dBA level would occur at distances somewhat shorter than 1.2 mi (1.9 km). If a 10-hour
30 daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential
31 areas (EPA 1974) would occur about 1,200 ft (370 m) from the power block area, which would
32 be well within the facility boundary. For construction activities occurring near the residences
33 closest to the southern SEZ boundary, estimated noise levels at the nearest residences would
34 be about 23 dBA, which is well below the typical daytime mean rural background level of
35 40 dBA. In addition, an estimated 40 dBA L_{dn} ¹² at these residences (i.e., no contribution from
36 construction activities) is well below the EPA guidance of 55 dBA L_{dn} for residential areas.
37 Accordingly, noise from construction activities would be drowned in the background noise level
38 at the nearest residences.
39

40 In addition, noise levels were estimated at the specially designated areas within 5-mi
41 (8-km) of the proposed Bullard Wash SEZ, which is the farthest distance that noise (except
42 extremely loud noise) would be discernable. There is only one specially designated area within
43

¹² For this analysis, background levels of 40 and 30 dBA for daytime and nighttime hours, respectively, were assumed, which result in a day-night average noise level (L_{dn}) of 40 dBA.

1 this area: Tres Alamos WA, which is about 3.4 mi (5.5 km) north of the SEZ. For construction
2 activities occurring near the northern SEZ boundary, the noise level is estimated to be about
3 28 dBA at the boundary of the Tres Alamos WA, which is well below the typical daytime mean
4 rural background level of 40 dBA. Thus, construction noise from the SEZ is not likely to
5 adversely affect the Tres Alamos WA (Manci et al. 1988), as discussed in Section 5.10.2.
6

7 Depending on soil conditions, pile driving might be required for installation of solar dish
8 engines. However, the pile drivers used, such as vibratory or sonic drivers, would be relatively
9 small and quiet, in contrast to the impulsive impact pile drivers frequently used at large-scale
10 construction sites. Potential impacts on the nearest residences would be anticipated to be
11 negligible, considering the distance (about 5.6 mi [9.0 km] from the SEZ boundary).
12

13 It is assumed that most construction activities would occur during the day, when noise is
14 better tolerated than at night because of the masking effects of background noise. In addition,
15 construction activities for a utility-scale facility are temporary in nature (typically a few years).
16 Construction within the proposed Bullard Wash SEZ would cause negligible but localized short-
17 term noise impacts on neighboring communities, even when construction would occur near the
18 southern proposed SEZ boundary, close to the nearest residences.
19

20 Construction activities could result in various degrees of ground vibration, depending
21 on the equipment used and construction methods employed. All construction equipment causes
22 ground vibration to some degree, but activities that typically generate the most severe vibrations
23 are high-explosive detonations and impact pile driving. As is the case for noise, vibration would
24 diminish in strength with distance. For example, vibration levels at receptors beyond 140 ft
25 (43 m) from a large bulldozer (87 VdB at 25 ft [7.6 m]) would diminish below the threshold of
26 perception for humans, which is about 65 VdB (Hanson et al. 2006). During the construction
27 phase, no major construction equipment that can cause ground vibration would be used, and no
28 residences or sensitive structures are located in close proximity. Therefore, no adverse vibration
29 impacts are anticipated from construction activities, including pile driving for dish engines.
30

31 Transmission lines would be constructed within a designated ROW to connect to the
32 nearest regional power grid. A regional 500-kV transmission line is located about 5 mi (8 km)
33 from the proposed Bullard Wash SEZ; thus, construction of a transmission line over this distance
34 would be needed to connect to the regional grid. For construction of transmission lines, noise
35 sources and their noise levels might be similar to construction noise sources at an industrial
36 facility of a comparable size. Transmission line construction for the Bullard Wash SEZ could
37 be performed in about 6 months. However, the area under construction along the transmission
38 line ROW would move continuously, and no particular area would be exposed to noise for a
39 prolonged period. Therefore, potential noise impacts on nearby residences along the transmission
40 line ROW, if any, would be minor and temporary in nature.
41

42 43 **8.2.15.2.2 Operations** 44

45 Noise sources common to all or most types of solar technologies include equipment
46 motion from solar tracking, maintenance and repair activities (e.g., washing mirrors or replacing

1 broken mirrors) at the solar array area, commuter/visitor/support/delivery traffic within and
2 around the solar facility, and control/administrative buildings, warehouses, and other auxiliary
3 buildings/structures. Diesel-fired emergency power generators and firewater pump engines
4 would be additional sources of noise, but their operations would be limited to several hours per
5 month (for preventive maintenance testing).
6

7 With respect to the main solar energy technologies, noise-generating activities in the
8 PV solar array area would be minimal, related mainly to solar tracking, if used. By comparison,
9 dish engine technology, which employs collector and converter devices in a single unit, generally
10 has the strongest noise sources.
11

12 For the parabolic trough and power tower technologies, most noise sources during
13 operations would be in the power block area, including the turbine generator (typically in an
14 enclosure), pumps, boilers, and dry- or wet-cooling systems. The power block is typically
15 located in the center of the facility. On the basis of a 250-MW parabolic trough facility with a
16 cooling tower (Beacon Solar, LLC 2008), simple noise modeling indicates that noise levels
17 around the power block would be more than 85 dBA, but about 51 dBA at the facility boundary,
18 and about 0.5 mi (0.8 km) from the power block area. For a facility located near the southern
19 SEZ boundary, the predicted noise level would be about 27 dBA at the nearest residences, about
20 5.6 mi (9.0 km) from the SEZ boundary, which is much lower than the typical daytime mean
21 rural background level of 40 dBA. Such noise from a solar facility would be indiscernible at
22 the nearest residences most of the time. If TES were not used (i.e., if the operation were limited
23 to daytime, 12 hours only¹³), the EPA guideline level of 55 dBA (as L_{dn} for residential areas)
24 would occur at about 1,370 ft (420 m) from the power block area and thus would not be
25 exceeded outside of the proposed SEZ boundary. At the nearest residences, about 40 dBA L_{dn}
26 (i.e., no contribution from facility operation) would be estimated, which is well below the EPA
27 guideline of 55 dBA L_{dn} for residential areas. However, day-night average noise levels higher
28 than those estimated above by using simple noise modeling would be anticipated if TES were
29 used during nighttime hours, as explained below and in Section 4.13.1.
30

31 On a calm, clear night typical of the proposed Bullard Wash SEZ setting, the
32 air temperature would likely increase with height (temperature inversion) because of strong
33 radiative cooling. Such a temperature profile tends to focus noise downward toward the ground.
34 There would be little, if any, shadow zone¹⁴ within 1 or 2 mi (1.6 or 3 km) of the noise source in
35 the presence of a strong temperature inversion (Beranek 1988). In particular, such conditions
36 add to the effect of noise being more discernable during nighttime hours, when the background
37 noise levels are lowest. To estimate the day-night average noise level (L_{dn}), 6-hour nighttime
38 generation with TES is assumed after 12-hour daytime generation. For nighttime hours under
39 temperature inversion, 10 dB is added to noise levels estimated from the uniform atmosphere
40 (see Section 4.13.1). On the basis of these assumptions, the estimated noise level at the nearest
41 residences (about 5.6 mi [9.0 km] from the SEZ boundary) would be 37 dBA, which is above the
42 typical nighttime mean rural background level of 30 dBA. The day-night average noise level is

13 Maximum possible operating hours at the summer solstice, but limited to 7 to 8 hours at the winter solstice.

14 A shadow zone is defined as the region in which direct sound does not penetrate because of upward diffraction.

1 estimated to be about 42 dBA L_{dn} , which is well below the EPA guideline of 55 dBA L_{dn} for
2 residential areas. The assumptions are conservative in terms of operating hours, and no credit
3 was given to other attenuation mechanisms; thus it is likely that noise levels would be lower than
4 42 dBA at the nearest residences, even if TES were used at a solar facility. Consequently,
5 operating parabolic trough or power tower facilities using TES and located near the southern
6 SEZ boundary could result in minor noise impacts on the nearest residences, depending on
7 background noise levels and meteorological conditions.
8

9 The estimated noise level associated with operation of a solar facility using TES near the
10 northern SEZ boundary would be about 31 dBA at the boundary of Tres Alamos WA, which is
11 below the typical daytime mean rural background level of 40 dBA. Thus, operation noise from
12 the SEZ is not likely to adversely affect the Tres Alamos WA (Manci et al. 1988).
13

14 In the permitting process, refined noise propagation modeling would be warranted along
15 with measurement of background noise levels.
16

17 The solar dish engine is unique among CSP technologies because it generates electricity
18 directly and does not require a power block. A single, large solar dish engine has relatively low
19 noise levels, but a solar facility might employ tens of thousands of dish engines, which would
20 cause high noise levels around such a facility. For example, the proposed 750-MW SES Solar
21 Two dish engine facility in California would employ as many as 30,000 dish engines (SES Solar
22 Two, LLC 2008). At the proposed Bullard Wash SEZ, on the basis of the assumption of dish
23 engine facilities of up to 643-MW total capacity (covering 80% of the total area, or 5,791 acres
24 [23.4 km²]), up to 25,740 25-kW dish engines could be employed. For a large dish engine
25 facility, several hundred step-up transformers would be embedded in the dish engine solar field,
26 along with a substation; however, the noise from these sources would be masked by dish engine
27 noise.
28

29 The composite noise level of a single dish engine would be about 88 dBA at a distance of
30 3 ft (0.9 m) (SES Solar Two, LLC 2008). This noise level would be attenuated to about 40 dBA
31 (typical of the mean rural daytime environment) within 330 ft (100 m). However, the combined
32 noise level from tens of thousands of dish engines operating simultaneously would be high in the
33 immediate vicinity of the facility; for example, about 49 dBA at 1.0 mi (1.6 km) and 45 dBA at
34 2 mi (3.2 km) from the boundary of the square-shaped dish engine solar field; both values are
35 higher than the typical daytime mean rural background level of 40 dBA. However, these levels
36 would occur at somewhat shorter distances than the aforementioned distances, considering noise
37 attenuation by atmospheric absorption and temperature lapse during daytime hours. To estimate
38 noise levels at the nearest residences, it was assumed that dish engines were placed all over the
39 Bullard Wash SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise
40 level at the nearest residences, about 5.9 mi (9.0 km) from the SEZ boundary, would be about
41 36 dBA, which is below the typical daytime mean rural background level of 40 dBA. On the
42 basis of 12-hour daytime operation, the estimated 41 dBA L_{dn} at these residences is well below
43 the EPA guideline of 55 dBA L_{dn} for residential areas. On the basis of other noise attenuation
44 mechanisms, noise levels at the nearest residences would be lower than the values estimated
45 above. However, noise from dish engines could adversely, albeit in a minor way, affect the
46 nearest residences, depending on background noise levels and meteorological conditions.

1
2 For dish engines placed all over the SEZ, the estimated noise level would be about
3 41 dBA at the boundary of Tres Aamos WA, which is comparable to a typical daytime mean
4 rural background level of 40 dBA. Thus, dish engine noise from the SEZ is not likely to
5 adversely affect the Tres Alamos WA (Manci et al. 1988).
6

7 Consideration of minimizing noise impacts is very important during the siting of dish
8 engine facilities. Direct mitigation of dish engine noise through noise control engineering could
9 also limit noise impacts.
10

11 During operations, no major ground-vibrating equipment would be used. In addition,
12 no sensitive structures are located close enough to the proposed Bullard Wash SEZ to experience
13 physical damage. Therefore, during operation of any solar facility, potential vibration impacts on
14 surrounding communities and vibration-sensitive structures would be negligible.
15

16 Transformer-generated humming noise and switchyard impulsive noises would be
17 generated during the operation of solar facilities. These noise sources would be located near the
18 power block area, typically near the center of a solar facility. Noise from these sources would
19 generally be limited within the facility boundary and not be heard at the nearest residences,
20 assuming a 6.1-mi (9.8-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and 5.6 mi
21 [9.0 km] to the nearest residences). Accordingly, potential impacts of these noise sources on the
22 nearest residences would be negligible.
23

24 For impacts from transmission line corona discharge noise during rainfall events
25 (Section 5.13.1.5), the noise level at 50 ft (15 m) and 300 ft (91 m) from the center of a 230-kV
26 transmission line tower would be about 39 and 31 dBA (Lee et al. 1996), respectively, typical of
27 daytime and nighttime mean background noise levels in rural environments. The noise levels at
28 65 ft (20 m) and 300 ft (91 m) from the center of 500-kV transmission line towers would be
29 about 49 and 42 dBA, typical of high-end and mean, respectively, daytime background noise
30 levels in rural environments. Corona noise includes high-frequency components, which may be
31 judged to be more annoying than other environmental noises. However, corona noise would not
32 likely cause impacts, unless a residence was located close to the source (e.g., within 500 ft
33 (152 m) of a 230-kV transmission line and 0.5 mi (0.8 km) of a 500-kV transmission line). The
34 proposed Bullard Wash SEZ is located in an arid desert environment, and incidents of corona
35 discharge would be infrequent. Therefore, potential impacts on nearby residents along the
36 transmission line ROW would be negligible.
37
38

39 **8.2.15.2.3 Decommissioning/Reclamation**

40
41 Decommissioning/reclamation requires many of the same procedures and equipment
42 used in traditional construction. Decommissioning/reclamation would include dismantling of
43 solar facilities and support facilities such as buildings/structures and mechanical/electrical
44 installations, disposal of debris, grading, and revegetation as needed. Activities for
45 decommissioning would be similar to those for construction but more limited. Potential
46 noise impacts on surrounding communities would be correspondingly lower than those for

1 construction activities. Decommissioning activities would be of short duration, and their
2 potential impacts would be negligible and temporary in nature due to considerable separation
3 distances. The same mitigation measures adopted during the construction phase could also
4 be implemented during the decommissioning phase.

5
6 Similarly, potential vibration impacts on surrounding communities and vibration-
7 sensitive structures during decommissioning of any solar facility would be lower than those
8 during construction and thus negligible.

9 10 **8.2.15.3 SEZ-Specific Design Features and Design Feature Effectiveness**

11
12
13 The implementation of required programmatic design features described in Appendix A,
14 Section A.2.2, would greatly reduce or eliminate the potential for noise impacts from
15 development and operation of solar energy facilities. Because of the considerable separation
16 distances to the nearest residences, most activities within the proposed Bullard Wash SEZ during
17 construction and operation are not anticipated to increase noise levels at the nearest residences.
18 Accordingly, no SEZ-specific design features are required.
19

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1 **8.2.16 Paleontological Resources**

2
3
4 **8.2.16.1 Affected Environment**

5
6 The surface geology of the proposed Bullard Wash SEZ is composed predominantly of
7 more than 100-ft (30-m) thick alluvial deposits ranging in age from the Pliocene to Holocene.
8 The alluvial deposits cover 4,209 acres (17 km²) within the SEZ, or 58% of the SEZ. Portions
9 of the SEZ are composed of residual materials developed in sedimentary rocks. These
10 discontinuous residual deposits account for 3,030 acres (12.3 km²), or 42%, of the SEZ. In the
11 absence of a PFYC map for Arizona, a preliminary classification of PFYC Class 3b is assumed
12 for the young Quaternary alluvial deposits and the residual materials. Class 3b indicates that
13 the potential for the occurrence of significant fossil materials is unknown and needs to be
14 investigated further (see Section 4.14 for a discussion of the PFYC system). There is a potential
15 for Miocene fauna from the basin fill deposits. Rhinoceros and camel have been documented at
16 Anderson Mine in southwestern Yavapai County (Morgan and White 2005). These finds indicate
17 the potential for other similar finds in the region.
18

19
20 **8.2.16.2 Impacts**

21
22 The potential for impacts on significant paleontological resources in the proposed SEZ is
23 unknown. A more detailed investigation of the alluvial deposits as well as the residual materials,
24 especially along the edge of the basin where Tertiary units are shallow or exposed, is needed
25 prior to project approval. A paleontological survey will likely be needed following consultation
26 with the BLM. The appropriate course of action would be determined as established in BLM
27 IM2008-009 (BLM 2007c) and IM2009-011 (BLM 2008a). Section 5.14 discusses the types of
28 impacts that could occur to any significant paleontological resources found within the Bullard
29 Wash SEZ. Impacts would be minimized through the implementation of required programmatic
30 design features described in Appendix A, Section A.2.2.
31

32 Indirect impacts on paleontological resources outside of the SEZ, such as through looting
33 or vandalism, are unknown but possible if any such resources are at or near the surface. Areas
34 adjacent to the SEZ should be investigated for surface outcrops of potential fossil-bearing
35 formations during the paleontological survey of the SEZ. Programmatic design features for
36 controlling water runoff and sedimentation would prevent erosion-related impacts on buried
37 deposits outside of the SEZ.
38

39 The nearest state or U.S. route is 5 mi (8 km) from the SEZ (State Route 71); thus a
40 new road is anticipated to be needed to access the proposed Bullard Wash SEZ, resulting in
41 approximately 36 acres (0.15 km²) of disturbance to PFYC Class 3b deposits, mostly alluvial
42 sediments to the southeast of the SEZ. Approximately 5 mi (8 km) of transmission line is
43 anticipated to be needed to connect to the nearest existing line northeast of the SEZ, resulting
44 in approximately 152 acres (0.62 km²) of disturbance also in areas classified as PFYC Class 3b,
45 including mostly alluvial but some residual deposits similar to the SEZ. The potential for impacts
46 on significant paleontological resources in the anticipated corridors is unknown. Similar to the

1 SEZ footprint, a more detailed investigation of the corridors is needed and a paleontological
2 survey will likely be required. Impacts on paleontological resources related to the creation of
3 new corridors not assessed in this PEIS would be evaluated at the project-specific level if new
4 road or transmission construction or line upgrades are to occur.
5

6 Programmatic design features requiring a stop work order in the event of an inadvertent
7 discovery of paleontological resources would reduce impacts by preserving some information
8 and allowing possible excavation of the resource, if warranted. Depending on the significance
9 of the find, it could also result in some modification to the project footprint. Since the SEZ is
10 located in an area classified as PFYC Class 3b, a stipulation would be included in permitting
11 documents to alert solar energy developers of the possibility of a delay if paleontological
12 resources are uncovered during surface-disturbing activities.
13
14

15 **8.2.16.3 SEZ-Specific Design Features and Design Feature Effectiveness**

16
17 Impacts would be minimized through the implementation of required programmatic
18 design features, including a stop-work stipulation in the event that paleontological resources
19 are encountered during construction, as described in Appendix A, Section A.2.2.
20

21 The need for and the nature of any SEZ-specific design features would depend on the
22 results of future paleontological investigations.
23
24

1 **8.2.17 Cultural Resources**

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4 **8.2.17.1 Affected Environment**

5
6
7 **8.2.17.1.1 Prehistory**

8
9 The proposed Bullard Wash SEZ is located in the northern Sonoran Desert within the
10 basin and range province in western Arizona. The earliest known use of the area was likely
11 during the Paleoindian Period, sometime between 12,000 and 10,000 B.P. Surface finds of
12 Paleoindian projectile points, the hallmark of the Clovis culture, have been found in the Juniper
13 Mountains, about 55 mi (89 km) north of the proposed Bullard Wash SEZ; however, the majority
14 of Paleoindian sites are concentrated in the southeastern portion of the state. In addition to
15 projectile points, the Clovis culture is characterized by a hunting and gathering subsistence
16 economy, following migrating herds of Pleistocene mega fauna. Paleoindian sites in Arizona
17 are typically characterized by either fluted or unfluted points, extinct mega fauna, chipped stone
18 tools, and bone and horn implements. Tools were fashioned from either chert or obsidian; the
19 closest known source of obsidian to the proposed Bullard Wash SEZ is 23 mi (37 km) to the
20 southeast in the Vulture Mountains. The majority of Paleoindian sites occur in the transition zone
21 between mountain and desert environments, and those that have been found in the desert are
22 located close enough to the transition zone so as to assume that they were likely located
23 there during Paleoindian times. Paleoindian sites that are found are usually either kill sites where
24 large numbers of animals were slaughtered, or sites that are thought to be base camps (Martin
25 and Plog 1973; Reid and Whittlesey 1997; NROSL 2009; Anduze et al. 2003).

26
27 The Archaic Period began at the end of the Pleistocene, about 10,000 B.P. to 8,000 B.P.,
28 and continued until the advent of ceramics, about 2,000 B.P. Also referred to as the Cochise
29 Culture, the Archaic lifeways were similar to those of their Paleoindian predecessors, hunting
30 and gathering wild animals and plants. However, plants took on a greater role because there was
31 no longer mega fauna to hunt, and smaller animals such as deer, antelope, and rabbits
32 were hunted. Consequently, plant processing tools, such as manos and metates, are more
33 prevalent in the archaeological record. Archaic peoples likely followed a seasonal round of
34 movement, harvesting and hunting what was available at that place and time; therefore these
35 ephemeral sites are difficult to distinguish. The Juniper Mountains, and the area around the
36 mountains, contain several Archaic Period sites, in addition to the few isolated Paleoindian finds
37 already mentioned. Because Archaic Period people were so mobile, they maintained light and
38 portable equipment; baskets, milling stones, and spear points are the hallmarks of the Archaic
39 culture. It is assumed that Archaic Period groups would have lived and traveled with groups of
40 related families when local resources were abundant, but during hard times groups likely
41 dispersed, separated from other families or bands by environmental features such as deserts or
42 mountain ranges. It is possible that groups may have isolated themselves in resource-rich regions
43 for sustained periods of time, resulting in vast tracts of land that would have been unpopulated
44 for long spans of time. Other artifacts associated with southern Arizonan Archaic Period lifeways
45 are sleeping circles or camp clearings, trails, shrines, rock alignments, and zoomorphic intaglios
46 (Reid and Whittlesey 1997; Anduze et al. 2003).

1 The Late Archaic Period saw the beginnings of agriculture in Arizona. The Sonoran
2 Desert is believed to have been the heartland from which corn agriculture spread to the rest of
3 Arizona. In the middle of the twentieth century, it was proposed that corn agriculture spread to
4 Arizona from Mexico via the Sierra Madre corridor to the Mogollon highlands, into the Colorado
5 Plateau, and then into the Sonoran Desert prior to being adopted by the rest of the region. More
6 recent research has suggested the opposite, that the Sonoran Desert's warm growing conditions
7 and the planting of corn at low elevations using well-watered floodplains was more conducive to
8 corn agriculture and the technology spread widely from the Sonoran Desert into the rest of
9 Arizona. While these Late Archaic farmers were growing corn, it was not their only means of
10 subsistence, and therefore they continued to maintain a seasonal round of hunting and gathering,
11 while maintaining a residence for a period of time near their fields to plant and harvest their
12 crops. Their base camps were located in the lowlands, likely occupied in the summer; these
13 clusters of houses usually formed a generally circular arrangement with pits located in the floors
14 of houses or in the areas between houses for the storage of tools and food. Often the floors of
15 houses were completely taken up by the storage pits, which, combined with the lack of hearths in
16 the houses, leads some archaeologists to believe that the primary function of the houses was for
17 storage and not habitation. Some Late Archaic sites have been found to have large, dome-shaped
18 structures, believed to be ceremonial in nature. The artifacts that have been found in these
19 structures were likely used in a religious context, such as a baton made of phyllite, pigments,
20 figurines, bone tubes, and worked shell pieces. It is believed that these structures were the
21 predecessors to the subsurface kivas constructed by later Southwestern groups. Late Archaic
22 groups also were known to have produced ceramics, although they were not fashioned into
23 containers but figurines and beads (Reid and Whittlesey 1997; Matson 1991).

24
25 The proposed Bullard Wash SEZ is situated in an area that is near the boundaries of
26 several different Formative Period culture groups—the Hohokam, the Patayan, and the Prescott
27 cultural tradition. The Hohokam were concentrated largely around the Gila River and its
28 tributaries; the Patayan were focused on the Colorado River and its tributaries; and the territory
29 of the Prescott cultural tradition extended from the modern-day Prescott area west to the Big
30 Sandy River Valley and the Juniper Mountains.

31
32 There are two branches of the Hohokam culture, the River Hohokam and the Desert
33 Hohokam, the Hohokam tradition beginning around A.D. 300 and extending until A.D. 1450.
34 The River Hohokam lived in large villages, sometimes occupied for hundreds of years, and
35 they utilized the rivers to irrigate their crops through the construction of canals. Their ability
36 to establish long-term occupations because of the reliable river as a water source, allowed for
37 extensive public architectural projects to be undertaken and craft specialization to occur. At
38 some River Hohokam sites, platform mounds and ball courts have been excavated. It has been
39 suggested that the construction of large-scale irrigation projects, platform mounds, and ball
40 courts is reflective of a complex social and political relationship among the Hohokam. The
41 Desert Hohokam relied on flood water and rainwater for farming. They lived in the valleys and
42 bajadas that were not near the river zones and planted their fields on alluvial fans and at the
43 mouth of washes. Because the Desert Hohokam relied on more ephemeral sources of water, they
44 did not develop the long-term occupation of sites and social complexity that the River Hohokam
45 were able to. Both the River and Desert Hohokam groups supplemented their diets through the
46 collection of wild plants and hunting, helping to provide some subsistence reliability during

1 difficult agricultural times. During the course of the Hohokam culture, settlements became more
2 and more densely populated, with shifts in material culture and changes in ceremonial and
3 agricultural practices occurring. The archaeological assemblage associated with the Hohokam
4 cultural tradition consists of ceramics (vessels and figurines); bedrock mortars; carved, ground,
5 and flaked stone artifacts; shell jewelry; and stone bowls with effigies. Evidence of Hohokam
6 occupation in the archaeological record becomes very sparse during the late fourteenth and
7 fifteenth centuries, suggesting that either the culture changed its lifeways significantly enough to
8 affect interpretation of cultural materials related to the Hohokam or the Hohokam left the area,
9 possibly due to excessive flooding, oversalinization of agricultural fields, or conflicts with
10 competing groups (Reid and Whittlesey 1997; BLM 2010a; McGuire and Schiffer 1982).

11
12 The Patayan culture occupied different regions of the Colorado River Valley; some
13 groups were concentrated in the upland environments, others in the lowlands. Similar to the
14 Desert Hohokam, the Patayan culture used floodwater to irrigate their crops, with the first
15 evidence of the Patayan culture seen around A.D. 700. Most Patayan sites were not permanent,
16 generally indicating temporary habitation or activity camps, although there are a few large
17 Patayan sites on the southwest portion of the Gila River representing longer-term village
18 settlements. It is believed that the Patayan and Hohokam maintained a friendly relationship,
19 with interaction between the groups increasing through time. The Patayan moved seasonally,
20 occupying the river valleys in the summer, maintaining their horticultural endeavors, and moving
21 to the uplands to exploit piñon nuts and other upland resources. Trade was important for the
22 Patayan people, and they created a vast network of trails, used not only for trade but for travel
23 and connecting ceremonial territories. Along the trails, cairns and shrines can be found, as well
24 as campsites, intaglios, cleared circles, and petroglyphs. It is believed that the Patayan culture
25 was the antecedent culture to some of the contemporary Native American groups that were in the
26 area: the Maricopa, Mohave, Quechan, and Yavapai, but some suggest Hohokam derivation
27 instead. Pima groups are thought to have been descended from the Hohokam culture (Reid and
28 Whittlesey 1997; BLM 2010a; Neusius and Gross 2007; McGuire and Schiffer 1982).

29
30 The Prescott cultural tradition was centered on the modern-day town of Prescott, Arizona,
31 and dated from about A.D. 800 to 1300. This group may have been an offshoot of the Patayans
32 with Hohokam influences, as evidenced in the ceramic and architectural styles. The Prescott
33 tradition manufactured black-on-gray pottery, also called Prescott ware, and constructed shallow,
34 slab-lined pit houses. They practiced a limited form of agriculture and relied primarily on
35 hunting and gathering. The most intensive occupation of the Prescott culture sites seems to have
36 occurred around A.D. 1000 to 1100, before about A.D. 1300 when some of the people may have
37 left the region or remained and became the ancestors of the modern-day Yavapai and Hopi tribes
38 (Stone 1986; Jeter 1977).

39 40 41 **8.2.17.1.2 Ethnohistory**

42
43 The proposed Bullard Wash SEZ, like the proposed Brenda SEZ, lies in the western part
44 of traditional Yavapai territory. This area was inhabited by the Tolkapaya or Western Yavapai.
45 Tolkapaya territory ranged from the mountains east of the Colorado, eastward to the western
46 slopes of Kirkland Valley (Khera and Mariella 1983). The proposed SEZ is just northeast of the

1 eastern end of the Harcuvar Mountains, the traditional home base of the Hakehelapa (people of
2 the running water) or Wiltaikakpaya (people of the two mountains) Bands (Gifford 1936).

5 **Yavapai**

7 The Yavapai were inhabitants of west-central Arizona who spoke a common language
8 and thought of themselves as one people. A general discussion of Yavapai ethnohistory is found
9 in Section 8.1.17.1.2. Like other Yavapai bands, the Hakehelapa or Wiltaikapaya depended on
10 a mixture of agriculture and a seasonal round of hunting and gathering for their subsistence.
11 Settlement size and duration were dictated by the abundance and availability of nearby resources.
12 In the Sonoran Desert, the presence of water, whether rivers, streams, springs, or natural tanks,
13 was essential, and sites in the Harcuvar Mountains generally cluster along the lower slopes of
14 the mountains and in canyons where springs and natural tanks are present, as well as wild food
15 resources not available on the valley floors (BLM 2008b). The Hakehelapa ranged from the
16 Harcuvar and Harquahala Mountains to Peebles and Kirkland Valleys, where they harvested
17 walnuts, acorns, piñon nuts, and prickly pear fruit (Gifford 1936). They may also have ranged
18 westward and planted crops along the Colorado River near other Yuman-speaking Tribes with
19 whom they were on good terms (Khera and Mariella 1983).

22 **8.2.17.1.3 History**

24 After Christopher Columbus landed in the Caribbean in 1492, Spanish exploration of
25 the Americas quickly ensued, with Spain claiming vast tracts of land in the New World in the
26 name of King Ferdinand and Queen Isabella. There is some debate as to which of the Spanish
27 explorers made the first entry into Arizona. Some historians believe it was Alvar Nunez Cabeza
28 de Vaca, a Spaniard who shipwrecked off the coast of Texas in 1528 and developed friendly
29 relations with the Native Americans who then helped to guide him to Mexico City. It has been
30 suggested that Cabeza de Vaca may have passed through the southeastern corner of Arizona on
31 his travels, but because he did not have any way of recording where he was, his exact route is
32 unknown. Cabeza de Vaca is important to the history of Arizona not just because he may have
33 been the first European presence in the state, but because he claimed to have been told and seen
34 some of the “Seven Cities of Cibola,” fictitious cities that were full of gold and wealth, ripe for
35 Spanish plundering. When Cabeza de Vaca eventually got to Mexico City in 1536, he spread
36 the rumors of these fabled cities, which led to the desire of other Spaniards to search for riches
37 in the hopes of finding another civilization rich in gold similar to the Aztec in Mexico. The first
38 documented expedition into what is today Arizona, was made under an expedition headed by
39 Fray Marcos de Niza in 1539. Fray Marcos wanted to assure the Native Americans whom he
40 encountered on his expedition that they would be treated well, as news of the poor treatment of
41 Native Americans by European explorers had preceded the actual presence of the explorers.
42 Accompanying Fray Marcos was an African slave, Estebanico, who had survived the journey
43 along with Cabeza de Vaca, and Francisco Vazquez de Coronado, the governor of a northern
44 Mexican province. After stopping in Mexico at Vacapa, Fray Marcos sent Estebanico ahead with
45 orders to scout the area and wait for the rest of the explorers. Estebanico did not follow Fray
46 Marcos’s instructions and entered into Arizona, where he may have reached the Piman villages

1 near Tucson, before heading farther north to the Zuni pueblo, Cibola. Estebanico was killed by
2 the Zuni, and Fray Marcos followed his trail north claiming all of the land along the way in the
3 name of New Spain. He claimed to have made it all the way to Cibola, and after returning to
4 Mexico City claimed to have seen vast riches, confirming Cabeza de Vaca's story. In 1540,
5 Francisco Vazquez de Coronado led an expedition into eastern Arizona in search of the rumored
6 cities full of gold, following the Sonora and San Pedro Rivers, then into New Mexico, and may
7 have made his way as far as Kansas before turning back to Mexico City empty handed. Also
8 funded by the Coronado expedition was Hernando de Alarcon, who sailed up the Gulf of
9 California and explored the Colorado delta area, perhaps, going as far north as the Gila and
10 Colorado confluence. When Coronado came back without any gold or any prospects for further
11 exploration, the Spanish stayed out of most of the hostile Arizona desert southwest for the next
12 40 years (Farish 1915; Sheridan 1995; Kessell 2002; BLM 2010a).

13
14 Antonio de Espejo explored portions of northern and central Arizona in 1583 in an
15 effort to find precious metals. Espejo traded with the Hopi and discovered silver and copper
16 deposits east of Prescott, Arizona, about 47 mi (76 km) to the northeast of the proposed
17 Bullard Wash SEZ. In 1604, Juan de Onate, a Mexican-born Spaniard who had settled in
18 northern New Mexico, explored portions of Arizona north of the SEZ along the Bill Williams
19 River, to its confluence with the Colorado River, and followed the Colorado River south to the
20 Gulf of California, likely coming within about 38 mi (61 km) to the northwest of the SEZ
21 (Sheridan 1995; Kessell 2002).

22
23 The Spanish did not maintain an established presence in Arizona, other than a few short-
24 lived missions in the south-central portion of the state, until the discovery of large silver deposits
25 near Nogales in 1736, 227 mi (365 km) to the southeast of the proposed Bullard Wash SEZ.
26 Most of the prospectors who came to mine the silver and stayed in Arizona were forced to make
27 their living as subsistence farmers and ranchers, as mining did not prove lucrative for another
28 100 years. The first permanent Spanish settlement in Arizona was at Tubac, located just north of
29 Nogales, in an effort to prevent uprisings of the O'odam Tribe. The Spanish attempted to build
30 permanent settlements along the Lower Colorado River, but hostile Yuman Tribes prevented any
31 sustained development. With Native Americans hostile to Spanish intrusion in the northern and
32 eastern portion of the state, Spanish settlement was basically restricted to the Tucson area and
33 south (Sheridan 1995; Kessell 2002).

34
35 Missionary explorer Eusebio Francisco Kino made nine different expeditions into the
36 territories of California and Arizona, establishing relationships with the Yuman and Piman
37 groups in the area, likely traversing the lower Colorado River to the west of the proposed
38 Bullard Wash SEZ. In 1775, Juan Batista de Anza was authorized by the viceroy of New Spain
39 to lead a group of settlers from Tubac to the San Francisco Bay area. De Anza set out along
40 the Santa Cruz River, which he followed to the Gila and Colorado confluence, and then into
41 California. This expedition established a trail that eventually became a congressionally
42 designated National Historic Trail, passing about 73 mi (118 km) to the south of the SEZ
43 (Sheridan 1995, Kessell 2002).

44
45 In 1810, Mexicans declared their independence from Spanish colonial rule, and
46 eventually won the war in 1821. Mexican authority and control in Arizona was disjointed, and

1 often states would act independently from the rest of the country. Increasingly tense relations
2 between Native Americans and the non-Native occupiers were intensified with the expansion
3 of ranchers and homesteaders into Native American areas, leading to several conflicts. The
4 Mexican–American War began in 1846 with the United States eyeing the Rio Grande River and
5 California territory, and two years later the Treaty of Guadalupe Hidalgo was signed, giving the
6 United States control of Texas, New Mexico (which included Arizona north of the Gila River),
7 and California. With the Gadsden Purchase in 1854, the United States gained control of Arizona
8 south of the Gila River and the Mesilla Valley of New Mexico, and settlement of the area
9 increased to previously unseen levels (Sheridan 1995; Kessell 2002).

10
11 Prior to the Mexican–American War, Americans had ventured into Arizona on fur-
12 trapping expeditions. The first known American fur trappers in Arizona were Sylvester Pattie
13 and his son James in 1825, trapping along the San Francisco, Gila and San Pedro Rivers in the
14 southeastern portion of the state. Frequently, hostilities broke out between Native Americans
15 and fur trappers, but the trappers did not remain in the state long enough to make much of an
16 economic or ecological impact. One of the largest United States expeditions to cross Arizona
17 at the time was made by the Mormon Battalion in 1846. Led by Lieutenant Colonel Phillip
18 St. George Cooke, the group intended to establish a wagon trail across the southern Great Plains
19 and the Southwest. The Mormon Battalion was the first representative of the United States
20 government to encounter the Mexican population of Arizona, a nonconfrontational meeting.
21 The trail that the Mormon Battalion took later became a part of the Gila Route, or Southern
22 Overland Route, a network of Native American and European trails that entered the state in the
23 east, converged on the Pima villages on the Gila River, and traversed the Gila River floodplain
24 to the Colorado and Gila River juncture (Sheridan 1995).

25
26 Most occupation of Arizona after the acquisition of the territory by the United States
27 government was concentrated in the southern part of the state in mining ventures. It was not until
28 the establishment of Fort Yuma on the California side of the Colorado River and other nearby
29 military garrisons (Camp Colorado near Parker, and Camp Date Creek just 15 mi (24 km)
30 northeast of the proposed Bullard Wash SEZ) that Americans began to settle in the region near
31 the SEZ. The forts provided the necessary security against Native Americans who resented the
32 American occupation of their land, and who were competing for the same resources as the
33 miners and ranchers settling in the desert. After the start of the Civil War, most of the military
34 personnel in Arizona were withdrawn, leaving the settlers to their own defenses until the end of
35 the war when the military returned (Sheridan 1995; Stone 1982).

36
37 In 1857, 20 mi (32 km) up the Gila River from the Colorado junction, Arizona’s first
38 boomtown, Gila City, was established after a small gold strike. The largest and most prosperous
39 gold mine in Arizona occurred at Vulture Mine, just 24 mi (39 km) to the southeast of the SEZ.
40 The town of Wickenburg was established in 1864 to support the influx of miners to the area,
41 becoming a prosperous town in the nineteenth century. The creation of canals, roads, and other
42 infrastructure developments helped to increase the population of Arizona and their ability to
43 grow crops, export and import goods, and maintain the mines. The Phoenix Stage Route was
44 established as part of this infrastructure, leading to Wickenburg becoming a transportation hub
45 and the headquarters of the Arizona–California Stage Company. During the 1870s, copper,
46 silver, and other less valuable minerals were mined fervently throughout the state, and with the

1 construction of the railroad in 1881 and 1882, mining increased. The Atchison, Topeka, and
2 Santa Fe Railroad was a key rail line that connected major cities in the American West, and a
3 branch of this railroad passes just 9 mi (15 km) to the south of the SEZ. Much of the early
4 mining in Arizona was undertaken in Yuma County, and by 1910, Arizona was the largest
5 producer of copper in the United States, and continues to be so. In the vicinity of the proposed
6 Bullard Wash SEZ, mining occurred in the Harcuvar Mountains to the immediate south of the
7 SEZ, the Black Mountains to the north, the Date Creek Mountains to the northeast, and the
8 Vulture Mountains to the southeast (Stone 1982; Sheridan 1995).
9

10 Settlement, ranching, and mining in Arizona are dependent upon water regulation and
11 dispersal, and consequently water control projects were started early in the development of
12 Arizona. Often prehistoric canals were used and/or expanded in order to facilitate water usage.
13 Just as in prehistoric times, people would generally only settle in places where water was
14 available. The CAP is currently the major supplier of water to Arizona. Transferring water
15 from the Colorado River, the aqueduct is 336 mi (541 km) long, and starts in Lake Havasu
16 and stretches to the south of Tucson. Initial construction on the CAP began in 1973 and was
17 completed in 1993, delivering 1.5 million ac-ft (1.9 billion m³) of water per year. Portions of
18 the CAP pass just 35 mi (56 km) to the south of the proposed Bullard Wash SEZ (Stone 1982).
19

20 The U.S. Military has a long relationship with the southwest desert. The vast, uninhabited
21 lands make it prime real estate to conduct training exercises. Large amounts of the desert to the
22 east of the proposed Bullard Wash SEZ were used for training troops for the North African
23 invasion in World War II, with bases and air fields placed throughout the desert. Most of those
24 bases are not very close to the proposed SEZ, except for the Luke Air Force Base. The base was
25 established for training pilots during World War II, and continues today to operate as a training
26 facility for the U.S. Air Force. Under the control of the Luke Air Force Base are the Barry M.
27 Goldwater Range and the Gila Bend Auxiliary Air Field. These ranges also serve as training
28 facilities for the U.S. Air Force in air-to-air and air-to-ground training. The closest portion of the
29 Luke Air Force Base complex to the proposed Bullard Wash SEZ is about 39 mi (64 km) to the
30 southeast, although the Bullard Wash SEZ is within the DoD's Airspace Consultation Area
31 (Bischoff 2000; Stone 1982).
32
33

34 ***8.2.17.1.4 Traditional Cultural Properties—Landscape*** 35

36 The Yavapai consider their traditional use area to be sacred land—the land where the
37 Yavapai first emerged and the land that they are divinely required to protect. This sacred
38 landscape is composed of an interrelated complex of important plants, animals, and places of
39 power, tied together by a network of trails linking the Colorado and Gila Valleys (Stone 1986).
40 From the Yavapai point of view, places, features, and artifacts of power are dangerous and can
41 only be handled, discussed, or visited safely by powerful religious practitioners. Their locations
42 and properties are not discussed openly. Because the Yavapai reservations are located in the
43 eastern part of their former traditional range, and because many knowledgeable elders familiar
44 with the western part of their traditional territory have passed away, over the years, knowledge of
45 ancestral places of power in the western part of Yavapai territory has been lost. Lacking specific
46 knowledge, the Yavapai of today believe that any artifacts of the past from these areas have the
47 potential for being powerful and should be treated with respect (Bean et al. 1978).
48

1 Places of power include caves, mountains, and small rock shrines. Certain minerals were
2 also thought to be imbued with power, particularly turquoise (Gifford 1936). Many of the most
3 important Yavapai sacred places are located well to the east of the proposed SEZ near Sedona
4 and the Verde River. Montezuma Well, a spring-fed lake in a limestone sink now located in
5 Montezuma Castle National Monument 86 mi (138 km) to the northeast, is considered by the
6 Yavapai to be the place where their ancestors first emerged into this world. A cave in Boynton
7 Canyon, 90 mi (146 km) to the northeast, located in the Sedona Red Rock Mountains of the
8 Coconino National Forest, is the most sacred Yavapai site, the place where First Woman, the
9 only survivor of the destruction of the third world according to Yavapai cosmology, lived.
10 Mountains in general may be the home of the *qaqáqə*, or “little people” who may be called
11 on for help in times of distress (Khera and Mariella 1983).
12

13 The Hakehelapa or Wilitaikapaya Band of the Western Yavapai was centered in the
14 Harcuvar and Harquahala Mountains, 2.1 mi (3.4 km) and 14 mi (23 km) southwest of the
15 proposed SEZ, respectively (Gifford 1936). Both ranges were well watered and provided a
16 variety of resources not available on the desert floor, and provided bighorn sheep habitat
17 (BLM 2008b). The Harquahala Mountains provide a “Sky Island” dominating the skyline for
18 100 mi (161 km) around. Peaks that dominate the skyline are likely to have cultural importance.
19 Archaeological remains, likely resulting from Yavapai occupation, are among the reasons it has
20 been designated an ACEC, including a SCRMA. The cultural importance of the Harquahala and
21 Harcuvar ranges must be determined in consultation with appropriate Native American Tribes.
22 The Black Butte ACEC, located about 18 mi (29 km) to the east, was a local source of obsidian
23 used for stone tools (BLM 2008b, 2010b). Evidence of Native American use of the Harcuvar
24 Mountains include camp sites, tool manufacturing areas, milling areas, rockshelters and rock art,
25 pictographs as well as petroglyphs, and crystals and minerals important to Native Americans.
26 Stone suitable for tool making from Harvucar was traded over a considerable distance
27 (BLM 2006, 2008b). Two SCRMA have been established there (BLM 2007a). As part of the
28 traditional use area of the Western Yavapai, any archaeological sites associated with Native
29 American populations, rock art panels, shrines, or geoglyphs found in the area are likely to be
30 constituent parts of a cultural landscape important to the Yavapai. The proposed Bullard Wash
31 SEZ is located at the base of the Harcuvar Mountains in Aguila Valley. It is likely that the
32 Western Yavapai made use of the resources available there, including cactus fruit, mesquite,
33 creosotebush, and small game such as jackrabbits.
34
35

36 ***8.2.17.1.5 Cultural Surveys and Known Archaeological and Historical Resources*** 37

38 No cultural resource surveys have been conducted in the proposed Bullard Wash SEZ;
39 therefore no cultural resources have been identified within the boundaries of the SEZ. However,
40 within 5 mi (8 km) of the SEZ, seven surveys have been conducted, resulting in the recording of
41 five sites, one of which is prehistoric; the other four are of an unknown temporal sequence. The
42 prehistoric site is a lithic reduction site and bedrock grinding stone, and has been determined
43 eligible for inclusion in the NRHP (AZSITE 2009, 2010).
44

45 The BLM has designated several ACECs and SCRMA in the vicinity of the proposed
46 Bullard Wash SEZ, as these areas have been determined to be rich in cultural resources and
47 worthy of having the cultural resources managed and protected by the BLM. The closest

1 designated area to the proposed Bullard Wash SEZ is the Harcuvar Mountain East SCRMA just
2 6 mi (10 km) to the west of the SEZ, and the Harcuvar Mountain West SCRMA, 25 mi (40 km)
3 to the west of the SEZ. These SCRMA's are designated to protect prehistoric habitation sites,
4 stone tool manufacture areas, milling areas, rock shelters and rock art, and historic transportation
5 route sites associated with mining, transportation, commerce, and military activities that occurred
6 during the nineteenth century. In the Harquahala Mountains 14 mi (23 km) to the southwest of
7 the SEZ, is the Harquahala ACEC, and within the boundaries of the Harquahala ACEC is the
8 Harquahala SCRMA. This ACEC and SCRMA are designated to protect the historic Harquahala
9 Peak Observatory and Historic District, which is listed in the NRHP; Ellison's Camp and historic
10 trails; and several prehistoric habitation camps, milling areas, and rock art sites. The Black Butte
11 ACEC is located 18 mi (29 km) south of the SEZ and is managed by the BLM to protect an
12 obsidian source that was used by Native Americans prehistorically and ecological resources.
13 Twenty-five miles (40 km) west of the proposed Bullard Wash SEZ is the Swansea ACEC and
14 SCRMA, designated to protect the historic mining sites associated with the Swansea Mining
15 District. The Weaver/Octave SCRMA, 22 mi (35 km) northeast of the SEZ, is designated to
16 protect the historic Rich Hill gold mine and associated historical sites. Beyond the 25-mi
17 (40-km) distance, there are two additional areas of note. The Wickenburg/Vulture SCRMA,
18 26 mi (42 km) east of the SEZ, is designated to protect the historic sites and roads associated
19 with mining and settlement of the area, as well as a prehistoric obsidian source. The Tule Creek
20 ACEC is 49 mi (79 km) to the east of the SEZ; the BLM manages this land to protect prehistoric
21 Fort Tule, a hilltop ruin, as well as historic miners' camps (BLM 2010b; BLM 2007a).

22 23 24 ***National Register of Historic Places***

25
26 There are no historic properties listed in the NRHP in the SEZ, or within 5 mi (8 km).
27 However, a prehistoric lithic reduction site less than 5 mi (8 km) northeast of the SEZ is
28 considered potentially eligible for inclusion in the NRHP.

29
30 There are 131 properties listed in the NRHP in Yavapai County, 67 of which are either
31 a part of the Prescott Multiple Resource Area (MRA) or in the vicinity of Prescott, about 47 mi
32 (75 km) northeast of the SEZ. The closest property listed in the NRHP to the proposed Bullard
33 Wash SEZ is Camp Date Creek, just 14 mi (23 km) to the northeast. Peeples Valley School is
34 situated about 25 mi (40 km) northeast of the SEZ. Twenty-three miles (37 km) southeast is the
35 Kay-El-Bar Ranch, which is just north of Wickenburg, in Maricopa County. The Wickenburg
36 MRA, about 25 mi (40 km) southeast of the SEZ, maintains 23 properties listed in the NRHP.
37 The Harquahala Peak Observatory and Historic District is about 22 mi (35 km) southwest of the
38 SEZ, in La Paz County, and the Rhoda Nohlecek House, in Wenden, La Paz County, is about
39 29 mi (46 km) to the southwest. Other properties listed in the NRHP, but that are 30 to 35 mi
40 (48 to 56 km) from the SEZ, include the Walnut Creek Bridge and Kirkland Store to the
41 northeast and the Morristown Store and Sun-up Ranch southeast of the proposed Bullard
42 Wash SEZ.

43 44 45 **8.2.17.2 Impacts**

46
47 Direct impacts on significant cultural resources could occur in the proposed Bullard
48 Wash SEZ; however, further investigation is needed as no cultural resource surveys have been

1 conducted within the boundaries of the SEZ. A cultural resources survey of the entire APE of a
2 proposed project, including consultation with affected Tribes, would first need to be conducted
3 to identify archaeological sites, historic structures and features, and traditional cultural
4 properties, and an evaluation would need to follow to determine whether any are eligible for
5 listing in the NRHP. The proposed Bullard Wash SEZ has potential for containing historic sites,
6 as homesteading, ranching, Civilian Conservation Corps projects, and mining occurred in the
7 vicinity of the SEZ. The potential for prehistoric sites also exists, as prehistoric groups likely
8 traversed the area in search of game. Possible impacts from solar energy development on
9 cultural resources that are encountered within the SEZ or along related ROWs, as well as
10 general mitigation measures, are described in more detail in Section 5.15. Impacts would be
11 minimized through the implementation of required programmatic design features as described
12 in Appendix A, Section A.2.2. Programmatic design features assume that the necessary surveys,
13 evaluations, and consultations will occur.

14
15 Programmatic design features to reduce water runoff and sedimentation would prevent
16 the likelihood of indirect impacts on cultural resources resulting from erosion outside the SEZ
17 boundary (including along ROWs).

18
19 The nearest transmission line is approximately 5 mi (8 km) to the northeast. It is
20 anticipated that a transmission connection would be considered at the shortest distance. A 5-mi
21 (8-km) transmission line, if constructed, would result in the disturbance of 152 acres (0.62 km²).
22 Four cultural resources have been identified that fall along the anticipated line, but they could
23 easily be avoided during design of the line. The nearest road, State Route 71, is 5 mi (8 km) to
24 the southeast. An access road, connecting the proposed SEZ to State Route 71, would result in
25 the disturbance of approximately 36 acres (0.15 km²); no known cultural resources have been
26 identified within this corridor. Impacts on cultural resources are possible in areas related to the
27 access and transmission corridors, as new areas of potential cultural significance could be
28 directly affected by the construction or opened to increased access from use. Indirect impacts,
29 such as vandalism or theft, could occur if significant resources were located in close proximity to
30 the corridors. Programmatic design features assume that the necessary surveys, evaluations, and
31 consultations will occur for the access road and transmission line, as with the project footprint
32 within the SEZ. Impacts on cultural resources related to the creation of new corridors not
33 assessed in this PEIS would be evaluated at the project-specific level if new road or transmission
34 construction or line upgrades are to occur.

35 36 37 **8.2.17.3 SEZ-Specific Design Features and Design Feature Effectiveness**

38
39 Programmatic design features to mitigate adverse effects on significant cultural
40 resources, such as avoidance of significant sites and features and cultural awareness training for
41 the workforce, are described in Appendix A, Section A.2.2.

42
43 SEZ-specific design features would be determined during consultation with the Arizona
44 SHPO and affected Tribes and would depend on the findings of the cultural surveys.

1 **8.2.18 Native American Concerns**

2
3 As discussed in Section 8.2.17, Native Americans tend to view their environment
4 holistically and share many environmental and socioeconomic concerns with other ethnic groups.
5 For a discussion of issues of possible Native American concern shared with the population as a
6 whole, several sections in this PEIS should be consulted. General topics of concern are addressed
7 in Section 4.16. Specifically for the proposed Bullard Wash SEZ, Section 8.2.8 discusses mineral
8 resources; Section 8.2.9.1.3 discusses water rights and water use; Section 8.2.10 discusses plant
9 species; 8.2.11 discusses wildlife species, including wildlife migration patterns; Section 8.2.13
10 discusses air quality; Section 8.2.14 discusses visual resources; Section 8.2.17 discusses
11 archaeological sites, structures, landscapes, and traditional cultural properties; and
12 Sections 8.2.19 and 8.2.20 discuss socioeconomics and environmental justice, respectively.
13 Issues of human health and safety are discussed in Section 5.21. This section focuses on
14 concerns that are specific to Native Americans and to which Native Americans bring a distinct
15 perspective.

16
17 All federally recognized tribes with traditional ties to the proposed Bullard Wash
18 SEZ have been contacted so that they could identify their concerns regarding solar energy
19 development. The tribes contacted with traditional ties to the Bullard Wash SEZ are listed in
20 Table 8.2.18-1. Appendix K lists all federally recognized tribes contacted for this PEIS.

21
22
23 **8.2.18.1 Affected Environment**

24
25 The territorial boundaries of the tribes that inhabited the Sonoran Desert appear to have
26 been fluid over time. Depending on existing relationships or amity or enmity, resources were
27 shared where abundant. The proposed Bullard Wash SEZ lies within the traditional range of the
28 Western Yavapai, but it may have been used from time to time by neighboring tribes that were
29 on good terms with the Yavapai. The Indian Claims Commission included the area in the
30 judicially established Yavapai traditional territory (Royster 2008).

31
32
**TABLE 8.2.18-1 Federally Recognized Tribes with
Traditional Ties to the Proposed Bullard Wash SEZs**

Tribe	Location	State
Cocopah Indian Tribe	Somerton	Arizona
Colorado River Indian Tribes	Parker	Arizona
Fort McDowell Yavapai Nation	Fountain Hills	Arizona
Fort Mojave Indian Tribe	Needles	California
San Carlos Apache Tribe	San Carlos	Arizona
Yavapai-Apache Nation	Camp Verde	Arizona
Yavapai-Prescott Indian Tribe	Prescott	Arizona

1 **8.2.18.1.1 Yavapai Territorial Boundaries**
2

3 Western Yavapai or Tolkapaya territory ranged from the mountains east of the Colorado
4 eastward to the western slopes of Kirkland Valley. The Tolkapaya also established gardens on
5 the floodplain of the Colorado River adjacent to their friends, the Quechan. On the north, they
6 ranged into the mountains north of the Bill Williams and Santa Maria Rivers. On the south they
7 sometimes ranged as far a Yuma, but for the most part, the mountains north of the Gila River
8 formed their southwestern boundary. On the southeast it extended to the Gila River (Khera and
9 Mariella 1983). Contrary to their relationships on their eastern and western borders, they were
10 not on good terms with neighboring tribes to the north and south. Yavapai descendants are found
11 primarily on the Fort McDowell, Camp Verde, Middle Verde, Clarkdale, and Prescott Yavapai
12 reservations, as well as the Cocopah and San Carlos Apache reservations.
13

14
15 **8.2.18.1.2 Plant Resources**
16

17 This section focuses on those Native American concerns that have an ecological as well
18 as cultural component. For many Native Americans, the taking of game or the gathering of plants
19 or other natural resources may have been seen as both a sacred and secular act (Bean et al. 1978;
20 Stoffle et al. 1990).
21

22 The traditional Yavapai subsistence base was a mixture of gardening and hunting and
23 gathering. The proportion of gardening to gathering varied with the land they occupied. The
24 proposed Bullard Wash SEZ does not appear to be well suited for indigenous agriculture,
25 lacking a reliable water source. It is adjacent to the relatively well-watered Harcuvar and
26 Harquahala Mountains that have been identified as in the traditional heartland of a Western
27 Yavapai band (Gifford 1936). While no archaeological surveys have been conducted within the
28 boundaries of the proposed SEZ, archaeological sites, some of which are associated with the
29 Yavapai, have been recorded in the mountains (BLM 2006, 2008b). Because of the proximity of
30 the proposed SEZ to mountains they inhabited, it is likely that the Yavapai gathered the plant
31 resources available in that area and hunted what game there was. The Yavapai practiced a
32 seasonal round in harvesting naturally occurring plant resources. Rural Yavapai commenting on
33 previous energy development projects in the area have voiced concern over the loss of culturally
34 important plants used for food, medicine, and ritual purposes and for making tools, implements,
35 and structures (Bean et al. 1978).
36

37 The plant communities observed or likely to be present at the proposed Bullard Wash
38 SEZ are discussed in Section 8.2.10. As shown in the gap analysis, the land cover at the
39 proposed Bullard Wash SEZ is predominantly Sonora-Mojave Creosote Bursage Desert Scrub,
40 interspersed with areas of Sonoran Mid-elevation Desert Scrub; and small patches of Sonoran
41 Paloverde-Mixed Cacti Desert Scrub, Apacherian-Chihuahuan Mesquite Upland Scrub, and
42 North American Warm Desert Riparian Mesquite Bosque (USGS 2005a). While these
43 communities appear sparse most of the year, seasonal rains often result in an explosion of
44 ephemeral herbaceous species.
45

1 Native American populations have traditionally made use of hundreds of native plants.
 2 Table 8.2.18.1-1 lists plants often mentioned as important by the Yavapai that were either
 3 observed at the proposed Bullard Wash SEZ or are probable members of the cover type plant
 4 communities identified for the SEZ. These plants are the dominant species; however, other
 5 plants important to Native Americans could occur in the SEZ, depending on localized
 6 conditions and the season. Overall, creosotebush dominates the SEZ, while cacti, mesquite,
 7 and sparse wild grasses are present. Creosotebush is important in traditional Native American
 8 medicine. Mesquite was among the most important food plants. Its long bean-like pods were
 9 harvested in the summer, could be stored, and were widely traded. Its blossoms are edible.
 10 Saltbush and buckwheat seeds were harvested, processed, and eaten. They, along with cactus
 11 fruit, were harvested in the summer (Khera and Mariella 1983).

12
 13
 14 **8.2.18.1.3 Other Resources**

15
 16 Water is an essential prerequisite for life in the arid areas of the Southwest. As long-time
 17 desert dwellers, Native Americans have a great appreciation for the importance of water in a
 18
 19

TABLE 8.2.18.1-1 Plant Species Important to Native Americans Observed or Likely To Be Present in the Proposed Bullard Wash SEZ

Common Name	Scientific Name	Status
Food		
Barrel Cactus	<i>Ferocactus</i> spp.	Observed
Buckwheat	<i>Eriogonum</i> spp.	Possible
Cholla Cactus	<i>Opuntia</i> spp.	Observed
Creosote Bush	<i>Larrea tridentata</i>	Observed
Honey Mesquite	<i>Prosopis Glandolosa</i>	Possible
Ironwood	<i>Olneya tesota</i>	Possible
Joboba	<i>Simmondsia chinensis</i>	Possible
Joshua Tree	<i>Yucca brevifolia</i>	Observed
Ocotillo	<i>Fouquieria splendens</i>	Observed
Prickly Pear Cactus	<i>Opuntia</i> spp.	Possible
Saguaro Cactus	<i>Carnegiea gigantean</i>	Possible
Saltbush	<i>Atriplex</i> spp.	Possible
Screwbean Mesquite	<i>Prosopis pubescens</i>	Possible
Yellow Palo verde	<i>Parkinsonia microphylla</i>	Possible
Medicine		
Creosotebush	<i>Larrea tridentata</i>	Possible
Mormon Tea	<i>Ephedra</i> spp.	Possible
Unspecified		
Bursage (Burro Bush)	<i>Ambrosia dumosa</i>	Possible

Sources: Field visit; Gifford (1936); Bean et al. (1978); Khera and Mariella (1983); USGS (2005a).

1 desert environment. They have expressed concern over the use and availability of water for solar
 2 energy installations (Jackson 2009). Tribes are also sensitive about the use of scarce local water
 3 supplies for the benefit of distant communities and recommend that determination of adequate
 4 water supplies be a primary consideration in deciding whether a site is suitable for the
 5 development of a utility-scale solar energy facility (Moose 2009).

6
 7 Close to their home range, the Yavapai are likely to have hunted in the Aguila Valley and
 8 the proposed Bullard Wash SEZ. The mountains adjacent to the SEZ provide habitat for deer and
 9 bighorn sheep, which may occasionally have been present in the valley as well. Traditionally,
 10 deer have been an important source of food and of bone, sinew, and hide used to make a variety
 11 of implements. Although pronghorn antelope were present on the nearby Harquahala Plain, they
 12 were not hunted by the Yavapai. While big game was highly prized, smaller animals, such as
 13 black-tailed jackrabbits and desert cottontail (both present in the SEZ), traditionally provided
 14 a larger proportion of the protein in their diet (Gifford 1936). Wildlife likely to be found in the
 15 proposed Bullard Wash SEZ is described in Section 8.2.11. Native American game species with
 16 ranges that include the SEZ are listed in Table 8.2.18.1-2.

TABLE 8.2.18.1-2 Animal Species Used by Native Americans with Ranges That Include the Proposed Bullard Wash SEZ

Common Name	Scientific Name	Seasonal Presence
Mammals		
Badger	<i>Taxidea taxus</i>	All year
Bighorn sheep	<i>Ovis Canadensis</i>	All year
Black-tailed jack rabbit	<i>Lepus californicus</i>	All year
Bobcat	<i>Lynx rufus</i>	All year
Wood rats	<i>Neotoma spp.</i>	All year
Coyote	<i>Canis latrans</i>	All year
Desert cottontail	<i>Silvilagus audubonii</i>	All year
Kit fox	<i>Vulpes macotis</i>	All year
Mule deer	<i>Odocoileus hemionus</i>	All year
Rock squirrel	<i>Spermophilus variegates</i>	All year
Birds		
Gambel's quail	<i>Callipepla gambelii</i>	All year
Doves		
Common ground dove	<i>Columbina passerina</i>	All year
White-winged dove	<i>Zenaida asiatica</i>	Summer
Mourning dove	<i>Zenaida macroura</i>	All year
Reptiles		
Desert tortoise	<i>Gopherus agassizii</i>	All year

Sources: Field visit; USGS (2005b); Gifford (1936); Bean et al. (1978); Khera and Mariella (1983).

1 Mineral resources important to Native Americans in the Colorado Desert include
2 turquoise, clay for pottery, stone for making tools, and quartz crystals considered to have
3 healing properties. Obsidian and quartz have been reported from the surrounding mountains
4 (BLM 2006, 2008b).

5
6 In addition, Native Americans have expressed concern over ecological segmentation, that
7 is, development that fragments animal habitat and does not provide corridors for movement.
8 They would prefer solar energy development take place on land that has already been disturbed,
9 such as abandoned farmland, rather than on undisturbed ground (Jackson 2009).

10 11 12 **8.2.18.2 Impacts**

13
14 To date, no comments have been received from the Tribes specifically referencing the
15 proposed Bullard Wash SEZ. However, in a response letter, the Quechan Indian Tribe of Fort
16 Yuma indicates that some of the SEZs proposed in this PEIS lie within their Tribal Traditional
17 Use Area. They stress the importance of evaluating impacts on landscapes as a whole. From their
18 perspective the intrusion of industrial development nearby would have negative effects on trails
19 (Jackson 2009).

20
21 Commenting on past transmission line projects in the area, rural Yavapai were primarily
22 concerned with wild resources. In order of importance the Yavapai expressed concerns for the
23 following resources: game animals (deer, birds, rabbits, mountain sheep), viewshed, cremation or
24 burial sites, wild food plants (squawbush, prickly pear, saguaro), minerals, rock art, sacred areas,
25 medicinal plants, and fiber plants (Bean et al. 1978).

26
27 The impacts that would be expected from solar energy development within the proposed
28 Bullard Wash SEZ on resources important to Native Americans fall into two major categories:
29 impacts on the landscape and impacts on discrete localized resources.

30
31 Potential landscape-scale impacts are those caused by the presence of an industrial
32 facility within a culturally important landscape that includes sacred mountains and other
33 geophysical features often tied together by a network of trails. Impacts may be visual (the
34 intrusion of an industrial feature in sacred space); audible (noise from the construction, operation
35 or decommissioning of a facility detracting from the traditional cultural values of the site); or
36 demographic (the presence of a larger number of outsiders in the area that would increase the
37 chance that the cultural importance of the area would be degraded by more foot and motorized
38 traffic). As consultation with the Tribes continues and project-specific analyses are undertaken,
39 it is possible that Native Americans will express concerns over potential visual effects of solar
40 energy development within the proposed SEZ on the landscape.

41
42 Localized effects could occur both within the proposed SEZ and in adjacent areas. Within
43 the SEZ, these effects would include the destruction or degradation of important plant resources;
44 destruction of the habitat of, and impeding the movement of, culturally important animal species;
45 destruction of archaeological sites and burials; and degradation or destruction of trails. Plant
46 resources are known to exist in the SEZ. Any ground-disturbing activity associated with the

1 development within the SEZ has the potential for destruction of localized resources. However,
2 significant tracts of Sonora-Mojave Creosote Bursage Desert Scrub and Sonoran Paloverde-
3 Mixed Cacti Desert Scrub would remain outside the SEZ, and anticipated overall effects on these
4 plant populations would be small. Animal species important to Native Americans are listed in
5 Table 8.2.18.1-2. While the construction of utility-scale solar energy facilities would reduce the
6 amount of habitat available to many of these species, similar habitat is abundant and the effect
7 on animal populations is likewise likely to be small.
8

9 Since solar energy facilities cover large tracts of ground, even taking into account the
10 implementation of programmatic design features, it is unlikely that avoidance of all resources
11 would be possible. Programmatic design features (see Appendix A, Section A.2.2) assume
12 that the necessary cultural surveys, site evaluations, and tribal consultations will occur.
13 Implementation of programmatic design features, as discussed in Appendix A, Section A.2.2,
14 should eliminate issues concerning impacts on Tribes' reserved water rights and the potential
15 for groundwater contamination.
16
17

18 **8.2.18.3 SEZ-Specific Design Features and Design Feature Effectiveness**

19
20 Programmatic design features to address impacts of potential concern to Native
21 Americans, such as avoidance of sacred sites, water sources, and tribally important plant and
22 animal species, are described in Appendix A, Section A.2.2.
23

24 The need for and nature of SEZ-specific design features regarding potential issues of
25 concern would be determined during government-to-government consultation with affected
26 Tribes listed in Table 8.2.18.1-1.
27

28 Mitigation of impacts on archaeological sites and traditional cultural properties is
29 discussed in Section 8.2.17.3, in addition to the design features for historic properties discussed
30 in Section A.2.2 in Appendix A.
31
32

1 **8.2.19 Socioeconomics**

2
3
4 **8.2.19.1 Affected Environment**

5
6 This section describes current socioeconomic conditions and local community services
7 within the ROI surrounding the proposed Bullard Wash SEZ. The ROI is a three-county
8 area comprising La Paz County, Maricopa County, and Yavapai County in Arizona. It
9 encompasses the area in which workers are expected to spend most of their salaries and in
10 which a portion of site purchases and nonpayroll expenditures from the construction, operation,
11 and decommissioning phases of the proposed SEZ facility are expected to take place.

12
13
14 **8.2.19.1.1 ROI Employment**

15
16 In 2008, employment in the ROI stood at 1,976,008 (Table 8.2.19.1-1). Over the period
17 1999 to 2008, the annual average employment growth rate was higher in Yavapai County (3.1%)
18 than in Maricopa County (2.1%) and La Paz County (0.6%). At 2.3%, the growth rate in the ROI
19 as a whole was the same as that for Arizona as a whole (2.3%).

20
21 In the ROI in 2006, the services sector provided the highest percentage of employment
22 at 47.2%, followed by wholesale and retail trade at 18.3% (Table 8.2.19.1-2). Smaller
23 employment shares were held by construction (10.4%) and finance, insurance, and real estate
24 (9.7%). Within the three counties in the ROI, the distribution of employment across sectors was
25 similar to that of the ROI as a whole, but employment in agriculture (11.4%) and wholesale and
26 retail trade was higher in La Paz County than in the ROI as a whole, with lower employment
27 shares in construction and finance, insurance, and real estate.

28
29 **TABLE 8.2.19.1-1 ROI Employment in the Proposed Bullard Wash SEZ**

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
La Paz County	6,621	7,023	0.6
Maricopa County	1,531,553	1,876,247	2.1
Yavapai County	68,097	92,638	3.1
ROI	1,606,271	1,976,008	2.3
Arizona	2,355,357	2,960,199	2.3

Sources: U.S. Department of Labor (2009a,b).

TABLE 8.2.19.1-2 ROI Employment in the Proposed Bullard Wash SEZ by Sector, 2006

Industry	La Paz County		Maricopa County		Yavapai County		ROI	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture ^a	493	11.4	11,098	0.7	928	1.4	12,519	0.7
Mining	60	1.4	1,835	0.1	1,750	2.7	3,645	0.2
Construction	136	3.1	171,087	10.3	8,406	13.0	179,629	10.4
Manufacturing	381	8.8	120,867	7.3	3,979	6.1	125,227	7.2
Transportation and public utilities	83	1.9	83,990	5.0	1,338	2.1	85,411	4.9
Wholesale and retail trade	1,114	25.7	302,087	18.1	13,449	20.7	316,650	18.3
Finance, insurance, and real estate	120	2.8	164,953	9.9	3,406	5.3	168,479	9.7
Services	1,990	46.0	815,970	49.0	31,926	49.3	818,479	47.2
Other	10	0.2	91	0.0	8	0.0	109	0.0
Total	4,329		1,665,052		64,816		1,734,197	

^a Agricultural employment includes 2007 data for hired farmworkers.

Sources: U.S. Bureau of the Census (2009a); USDA (2009a).

1 **8.2.19.1.2 ROI Unemployment**
2

3 Unemployment rates have been significantly different in the three counties in the ROI.
4 Over the period 1999 to 2008, the average rate in La Paz County (6.7%) was much higher than
5 the rates in Yavapai County (4.5%) and Maricopa County (4.2%) (Table 8.2.19.1-3). The
6 average rate in the ROI over this period was 4.2%, lower than the average rate for Arizona as a
7 whole (4.8%). Unemployment rates for 2009 contrast with rates for 2008; in Yavapai County,
8 the unemployment rate increased to 9.5%; in La Paz County, to 9.1%; and in Maricopa County,
9 to 8.3%. The average rates for the ROI (8.3%) and for Arizona (9.1%) as a whole in 2009 were
10 also higher than the corresponding average rates for 2008.
11

12
13 **8.2.19.1.3 ROI Urban Population**
14

15 The population of the ROI in 2008 was more than 92% urban (Table 8.2.19.1-4). The
16 largest urban area, Phoenix, had an estimated 2008 population of 1,577,812; other large cities
17 include Mesa (459,160), Chandler (252,885), Glendale (250,746), Scottsdale (236,496), Tempe
18 (171,444), and Peoria (158,093). These cities are part of the Phoenix metropolitan region, and
19 most are more than 100 mi (161 km) from the site of the proposed SEZ.
20

21 Population growth rates among the cities in Maricopa County varied over the period
22 2000 to 2008. Buckeye grew at an annual rate of 28.1% during this period; higher-than-average
23 growth was also experienced in Queen Creek (23.8), Goodyear (16.0), El Mirage (15.9%),
24 Surprise (14.7%), and Avondale (10.7%). Nine other cities in the county had growth rates that
25 were higher than the state average (3.5%).
26

27 In La Paz County, there are two small towns, Quartzite (3,468) and Parker (3,116), where
28 population growth from 2000 to 2008 was relatively low, varying from 1.2% in Quartzite, to
29 -0.1% in Parker. In Yavapai County, there are six small cities with a population of more than
30
31

TABLE 8.2.19.1-3 ROI Unemployment Rates (%) for the Proposed Bullard Wash SEZ

Location	1999–2008	2008	2009
La Paz County	6.7	7.4	9.1
Maricopa County	4.2	5.1	8.3
Yavapai County	4.5	5.9	9.5
ROI	4.2	5.2	8.3
Arizona	4.8	5.5	9.1

Sources: U.S. Department of Labor (2009a–c).

TABLE 8.2.19.1-4 ROI Urban Population and Income for the Proposed Bullard Wash SEZ

City	Population			Median Household Income (\$ 2008)		
	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	1999	2006–2008	Average Annual Growth Rate, 1999 to 2006–2008 (%) ^a
Phoenix	1,321,045	1,577,812	2.2	53,055	49,933	-0.7
Mesa	396,375	459,160	1.9	55,128	51,180	-0.8
Chandler	176,581	252,885	4.6	75,211	70,924	-0.7
Glendale	218,812	250,746	1.7	57,957	52,083	-1.2
Scottsdale	202,705	236,496	1.9	74,012	72,033	-0.3
Gilbert	109,697	211,892	8.6	87,592	80,705	-0.9
Tempe	158,625	171,444	1.0	54,540	50,147	-0.9
Peoria	108,364	158,093	4.8	67,207	65,730	-0.2
Surprise	30,848	92,679	14.7	56,852	64,465	1.4
Avondale	35,883	81,111	10.7	63,285	61,665	-0.3
Goodyear	18,911	62,170	16.0	74,022	76,823	0.4
Buckeye	6,537	47,340	28.1	45,814	65,514	4.1
Prescott	33,938	42,506	2.9	45,637	43,386	-0.6
Prescott Valley	23,535	38,215	6.2	44,215	42,310	-0.5
Fountain Hills	20,235	25,170	2.8	79,335	81,377	0.3
El Mirage	7,609	24,701	15.9	43,535	52,109	2.0
Queen Creek	4,316	23,850	23.8	82,017	78,828	-0.4
Paradise Valley	13,664	14,949	1.1	193,421	NA ^b	NA
Sedona	10,192	11,561	1.6	56,705	NA	NA
Cottonwood	9,179	11,385	2.7	35,335	NA	NA
Chino Valley	7,835	11,136	4.5	41,573	NA	NA
Camp Verde	9,451	10,892	1.8	41,031	NA	NA
Tolleson	4,974	7,179	4.7	49,921	NA	NA
Wickenburg	5,082	6,618	3.4	40,835	NA	NA
Guadalupe	5,228	5,936	1.6	38,740	NA	NA
Cave Creek	3,728	5,416	4.8	77,171	NA	NA
Litchfield Park	3,810	5,116	3.8	92,540	NA	NA
Youngtown	3,010	4,885	6.2	29,824	NA	NA
Clarkdale	3,422	4,251	2.7	44,948	NA	NA
Carefree	2,927	3,852	3.5	114,205	NA	NA
Dewey-Humboldt	3,421	3,827	1.4	47,431	NA	NA
Quartzite	3,354	3,468	1.2	54,068	NA	NA
Parker	3,140	3,116	-0.1	29,681	NA	NA
Gila Bend	1,980	1,830	-1.0	34,744	NA	NA
Jerome	329	379	1.8	35,866	NA	NA

^a Data are averages for the period 2006 to 2008.

^b NA = not available.

Sources: U.S. Bureau of the Census (2009b–d).

1 10,000, Prescott (42,506) and Prescott Valley (38,215) being the largest. Population growth
2 from 2000 to 2008 was relatively high in Prescott Valley (6.2%) and Chino Valley (4.5%), with
3 annual growth rates of 2.9% in Prescott and 2.7% in Clarkdale and in Cottonwood. The majority
4 of these cities are more than 30 mi (48 km) from the site of the proposed SEZ.
5
6

7 **8.2.19.1.4 ROI Urban Income**

8
9 Median household incomes varied considerably across cities in the ROI
10 (Table 8.2.19.1-4). Of the cities for which data are available for 2006 to 2008, there were
11 10 cities with median household incomes that were higher than the state average (\$56,348); of
12 these, Fountain Hills (\$81,377) and Gilbert (\$80,705) had the highest incomes. A number of
13 cities, including Paradise Valley (\$193,421), Carefree (\$114,205), Litchfield Park (\$92,540),
14 and Cave Creek (\$77,171) had median incomes in 1999 that were higher than the state average
15 (\$57,999). Five cities, including Phoenix (\$49,933), Tempe (\$50,147), and Mesa (\$51,180) had
16 median incomes in 2006 to 2008 that were lower than the state average.
17

18 Among the cities in Maricopa County for which data are available, median income
19 growth rates between 1999 and 2006 to 2008 were highest in Buckeye (4.1%), El Mirage (2.0%),
20 and Surprise (1.4%), with annual growth rates of less than 1% elsewhere. Ten cities in the county
21 had negative growth rates between 1999 and 2006 to 2008. The average median household
22 income growth rate for the state as a whole over this period was -0.2%.
23

24 All cities in La Paz County and Yavapai County had median incomes in 1999 that
25 were lower than the average for the state (\$57,399) (Table 8.2.19.1-4). Of these cities,
26 Sedona (\$56,705) and Quartzite (\$54,068) had the highest median incomes, followed by
27 Dewey-Humboldt (\$47,431) and Prescott (\$45,637). Median incomes in Parker (\$29,681)
28 were around half the state average in 1999.
29

30 Data on median household incomes for the period 2006 to 2008 are available for only
31 two cities in Yavapai County. Both Prescott (-0.6%) and Prescott Valley (-0.5%) had median
32 income growth rates that were negative for the period 1999 and 2006 to 2008.
33
34

35 **8.2.19.1.5 ROI Population**

36
37 Table 8.2.19.1-5 presents recent and projected populations in the ROI and state as a
38 whole. Population in the ROI stood at 4,193,198 in 2008, having grown at an average annual
39 rate of 3.2% since 2000. Growth rates for the ROI were higher than those for Arizona (3.0%)
40 over the same period.
41

42 Each county in the ROI experienced growth in population from 2000 to 2008; population
43 in Maricopa County and Yavapai County grew at an annual rate of 3.2%; the rate in La Paz
44 County (0.2%) was lower. The ROI population is expected to increase to 5,711,375 by 2021 and
45 5,916,249 by 2023.
46

TABLE 8.2.19.1-5 ROI Population for the Proposed Bullard Wash SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
La Paz County	19,715	20,005	0.2	25,757	26,302
Maricopa County	3,072,149	3,958,263	3.2	5,374,643	5,568,104
Yavapai County	167,517	214,930	3.2	310,975	321,843
ROI	3,259,381	4,193,198	3.2	5,711,375	5,916,249
Arizona	5,130,632	6,499,377	3.0	8,945,447	9,271,163

Sources: U.S. Bureau of the Census (2009e,f); Arizona Department of Commerce (2010).

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8.2.19.1.6 ROI Income

Total personal income in the ROI stood at \$158.1 billion in 2007 and grew at an annual average rate of 4.1% over the period 1998 to 2007 (Table 8.2.19.1-6). Per-capita income also rose over the same period at a rate of 1.1%, increasing from \$34,442 to \$38,515. Per-capita incomes in 2007 were higher in Maricopa County (\$38,998) than Yavapai County (\$30,970) and La Paz County (\$25,124). Growth rates in total personal income were slightly higher in Yavapai County (4.4%) and Maricopa County (4.0%), with higher growth rates in per-capita incomes in La Paz County. Personal income growth rates in the ROI were higher than the rate for Arizona (3.8%), but per-capita income growth rates in the ROI were the same as those in Arizona as a whole (1.1%).

Median household income over the period 2006 to 2008 varied from \$56,555 in Maricopa County to \$43,610 in Yavapai County and \$30,797 in La Paz County (U.S. Bureau of the Census 2009d).

8.2.19.1.7 ROI Housing

In 2007, more than 1,656,235 housing units were located in the three ROI counties; about 93% of these were located in Maricopa County (Table 8.2.19.1-7). Owner-occupied units compose approximately 68% of the occupied units in the two counties; rental housing made up 32% of the total. Vacancy rates in 2007 were 38.5% in La Paz County, 14.1% in Yavapai County, and 12.9% in Maricopa County; 3.7% of housing units in the ROI were used for seasonal or recreational purposes. With an overall vacancy rate of 13.4% in the ROI, there were 221,998 vacant housing units in the ROI in 2007, of which 70,383 are estimated to be rental units that would be available to construction workers. There were 60,916 units in seasonal, recreational, or occasional use at the time of the 2000 Census.

TABLE 8.2.19.1-6 ROI Personal Income for the Proposed Bullard Wash SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
La Paz County			
Total income ^a	0.4	0.5	3.3
Per-capita income	19,345	25,124	2.6
Maricopa County			
Total income ^a	101.7	151.0	4.0
Per-capita income	34,944	38,998	1.1
Yavapai County			
Total income ^a	4.3	6.6	4.4
Per-capita income	26,995	30,970	1.4
ROI			
Total income ^a	106.3	158.1	4.1
Per-capita income	34,442	38,515	1.1
Arizona			
Total income ^a	149.2	215.8	3.8
Per-capita income	30,551	33,926	1.1

^a Unless indicated otherwise, values are reported in \$ billion 2008.

Sources: U.S. Department of Commerce (2009); U.S. Bureau of the Census (2009e,f).

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Housing stock in the ROI as a whole grew at an annual rate of 3.0% over the period 2000 to 2007, with 309,141 new units added to the existing housing stock (Table 8.2.19.1-6).

The median value of owner-occupied housing in 2006 to 2008 varied from \$95,300 in La Paz County, to \$247,200 in Yavapai County, to \$263,600 in Maricopa County (U.S. Bureau of the Census 2009g).

8.2.19.1.8 ROI Local Government Organizations

The various local and county government organizations in the ROI are listed in Table 8.2.19.1-8. In addition, there are nine Tribal governments located in the county, with members of other Tribal groups located in the area whose Tribal governments are located in adjacent counties or states.

**TABLE 8.2.19.1-7 ROI Housing Characteristics
for the Proposed Bullard Wash SEZ**

Parameter	2000	2007 ^a
La Paz County		
Owner-occupied	6,521	7,312
Rental	1,841	2,322
Vacant units	6,771	6,029
Seasonal and recreational use	5,234	NA
Total units	15,133	15,663
Maricopa County		
Owner-occupied	764,547	910,811
Rental	368,339	427,237
Vacant units	117,345	198,423
Seasonal and recreational use	49,637	NA
Total units	1,250,231	1,536,471
Yavapai County		
Owner-occupied	51,519	61,400
Rental	18,652	25,155
Vacant units	11,559	14,723
Seasonal and recreational use	6,045	NA
Total units	81,730	104,101
ROI		
Owner-occupied	822,587	979,523
Rental	388,832	454,714
Vacant units	135,675	221,998
Seasonal and recreational use	60,916	NA
Total units	1,347,094	1,656,235

^a 2007 data for number of owner-occupied, rental, and vacant units for California counties are not available; data are based on 2007 total housing units and 2000 data on housing tenure.

^b NA = data not available.

Sources: U.S. Bureau of the Census (2009h-j).

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8.2.19.1.9 ROI Community and Social Services

This section describes educational, health care, law enforcement, and firefighting resources in the ROI.

TABLE 8.2.19.1-8 ROI Local Government Organizations and Social Institutions in the Proposed Bullard Wash SEZ

Governments

City

Avondale	Litchfield Park
Buckeye	Mesa
Camp Verde	Paradise Valley
Carefree	Parker
Cave Creek	Peoria
Chandler	Phoenix
Chino Valley	Prescott
Clarkdale	Prescott Valley
Cottonwood	Quartzite
Dewey-Humboldt	Queen Creek
El Mirage	Scottsdale
Fountain Hills	Sedona
Gila Bend	Surprise
Gilbert	Tempe
Glendale	Tolleson
Goodyear	Wickenburg
Guadalupe	Youngtown
Jerome	

County

La Paz	Yavapai
Maricopa	

Tribal

- Ak Chin Indian Community of the Maricopa (Ak Chin) Indian Reservation, Arizona
 - Colorado River Indian Tribes of the Colorado River Indian Reservation, Arizona and California
 - Fort McDowell Yavapai Nation, Arizona
 - Fort Mojave Indian Tribe of Arizona, California & Nevada
 - Gila River Indian Community of the Gila River Indian Reservation, Arizona
 - Hualapai Indian Tribe of the Hualapai Indian Reservation, Arizona
 - Salt River Pima-Maricopa Indian Community of the Salt River Reservation, Arizona
 - Yavapai-Apache Nation of the Camp Verde Indian Reservation, Arizona
 - Yavapai-Prescott Tribe of the Yavapai Reservation, Arizona
-

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

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Schools

In 2007, the three-county ROI had a total of 858 public and private elementary, middle, and high schools (NCES 2009). Table 8.2.19.1-9 provides summary statistics for enrollment and educational staffing and two indices of educational quality—student-teacher ratios and levels of service (number of teachers per 1,000 population). The student-teacher ratio in Maricopa County schools (18.8) is slightly higher than that in Yavapai County schools (17.9) and in La Paz County

TABLE 8.2.19.1-9 ROI School District Data for the Proposed Bullard Wash SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service ^a
La Paz County	2,591	160	16.2	8.0
Maricopa County	624,346	33,244	18.8	8.6
Yavapai County	23,244	1,296	17.9	6.1
ROI	650,181	34,700	18.7	8.5

^a Number of teachers per 1,000 population.

Source: NCES (2009).

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(16.2). The level of service is slightly higher in Maricopa County (8.6) than in La Paz County (8.0) and Yavapai County (6.1), where there are fewer teachers per 1,000 population.

Health Care

The total number of physicians (11,993) is much higher in Maricopa County than elsewhere in the ROI, but the number of physicians per 1,000 population in Maricopa County (3.1) is only slightly higher than in Yavapai County (2.8), which is higher than in La Paz County (1.0) (Table 8.2.19.1-10).

TABLE 8.2.19.1-10 Physicians in the Proposed Bullard Wash SEZ ROI, 2007

Location	Number of Primary Care Physicians	Level of Service ^a
La Paz County	20	1.0
Maricopa County	11,993	3.1
Yavapai County	593	2.8
ROI	12,606	3.1

^a Number of physicians per 1,000 population.

Source: AMA (2009).

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16
17

1 **Public Safety**

2
3 Several state, county, and local police departments provide law enforcement in the ROI
4 (Table 8.2.19.1-11). Yavapai County has 132 officers and would provide law enforcement
5 services to the SEZ; there are 763 officers in Maricopa County and 36 officers in La Paz County
6 Levels of service of police protection are 1.8 per 1,000 population in La Paz County, 0.6 in
7 Yavapai County, and 0.2 in Maricopa County. Currently, there are 3,451 professional firefighters
8 in the ROI (Table 8.2.19.1-11).

9
10
11 **8.2.19.1.10 ROI Social Structure and Social Change**

12
13 Community social structures and other forms of social organization within the ROI
14 are related to various factors, including historical development, major economic activities
15 and sources of employment, income levels, race and ethnicity, and forms of local political
16 organization. Although an analysis of the character of community social structures is beyond
17 the scope of the current programmatic analysis, project-level NEPA analyses would include a
18 description of ROI social structures, contributing factors, their uniqueness, and consequently,
19 the susceptibility of local communities to various forms of social disruption and social change.

20
21 Various energy development studies have suggested that once the annual growth in
22 population is between 5 and 15% in smaller rural communities, alcoholism, depression, suicide,
23 social conflict, divorce, and delinquency increase and levels of community satisfaction
24 deteriorate (BLM 1980, 1983, 1996). Data on violent crime and property crime rates and on
25 alcoholism and illicit drug use, mental health, and divorce, which might be used as indicators
26 of social change, are presented in Tables 8.2.19.1-12 and 8.2.19-1.13, respectively.

27
28 **TABLE 8.2.19.1-11 Public Safety Employment in the Proposed
Bullard Wash SEZ ROI**

Location	Number of Police Officers ^a	Level of Service ^b	Number of Firefighters ^c	Level of Service
La Paz County	36	1.8	14	0.7
Maricopa County	763	0.2	3,154	0.8
Yavapai County	132	0.6	283	1.3
ROI	931	0.2	3,451	0.8

^a 2007 data.

^b Number per 1,000 population.

^c 2008 data; number does not include volunteers.

Sources: Fire Departments Network (2009); U.S. Department of Justice (2008).

TABLE 8.2.19.1-12 County and ROI Crime Rates for the Proposed Bullard Wash SEZ^a

	Violent Crime ^b		Property Crime ^c		All Crime	
	Offenses	Rate	Offenses	Rate	Offenses	Rate
La Paz County	226	11.3	2,111	105.5	2,337	116.8
Maricopa County	18,719	4.7	171,143	43.2	189,682	48.0
Yavapai County	759	3.5	5,030	23.4	5,789	26.9
ROI	19,704	4.7	178,284	42.5	197,988	47.2

^a Rates are the number of crimes per 1,000 population; data are for 2008.

^b Violent crime includes murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault.

^c Property crime includes burglary, larceny, theft, motor vehicle theft, and arson.

Sources: U.S. Department of Justice (2009a,b).

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TABLE 8.2.19.1-13 Alcoholism, Drug Use, Mental Health and Divorce in the Proposed Bullard Wash SEZ ROI^a

Geographic Area	Alcoholism	Illicit Drug Use	Mental Health ^b	Divorce ^c
Arizona Rural South Region (includes La Paz County)	7.3	2.6	8.8	— ^d
Arizona Maricopa	8.6	2.8	10.7	—
Arizona Rural North Region (includes Yavapai County)	9.3	2.8	8.8	
Arizona				3.9

^a Data for alcoholism and drug use represent percentage of the population over 12 years of age with dependence or abuse of alcohol, illicit drugs. Data are averages for 2004 to 2006.

^b Data for mental health represent percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

^c Divorce rates are the number of divorces per 1,000 population. Arizona data are for 2007; California data are for 1990.

^d A dash indicates not applicable.

Sources: SAMHSA (2009); CDC (2009).

3
4

1 There is some variation in the level of crime across the ROI, with higher rates of violent
2 crime in La Paz County (11.3 per 1,000 population) than in Maricopa County (4.7) and Yavapai
3 County (3.5) (Table 8.2.19.1-12).

4
5 Property-related crime rates are also higher in La Paz County (105.5) than in Maricopa
6 County (43.2) and Yavapai County (23.4); that is, overall crime rates in La Paz County (116.8)
7 were higher than in Maricopa County (48.0) and Yavapai County (26.9).

8
9 Data on other measures of social change—alcoholism, illicit drug use, and mental
10 health—are not available at the county level and thus are presented for the SAMHSA region in
11 which the ROI is located. There is some variation across the three regions in which the three ROI
12 counties are located; rates for alcoholism are slightly higher in the region in which Yavapai
13 County is located; rates of illicit drug use are slightly lower in the region in which La Paz County
14 is located; and rates of mental illness are slightly higher in the Arizona Maricopa region
15 (Table 8.2.19.1-13).

16 17 18 **8.2.19.1.11 Recreation**

19
20 Various areas in the vicinity of the proposed SEZ are used for recreational purposes;
21 natural, ecological, and cultural resources in the ROI attract visitors for a range of activities,
22 including hunting, fishing, boating, canoeing, wildlife watching, camping, hiking, horseback
23 riding, mountain climbing, and sightseeing. These areas are discussed in Section 8.2.5.

24
25 Because the number of visitors using state and federal lands for recreational activities
26 is not available from the various administering agencies, basing the value of recreational
27 resources in these areas solely on the number of recorded visitors is likely to be an
28 underestimation. In addition to visitation rates, the economic valuation of certain natural
29 resources can also be assessed in terms of the potential recreational destination for current
30 and future users, that is, their nonmarket value (see Appendix M).

31
32 Another method is to estimate the economic impact of the various recreational activities
33 supported by natural resources on public land in the vicinity of the proposed solar development,
34 by identifying sectors in the economy in which expenditures on recreational activities occur. Not
35 all activities in these sectors are directly related to recreation on state and federal lands; some
36 activity occurs on private land (e.g., dude ranches, golf courses, bowling alleys, and movie
37 theaters). Expenditures associated with recreational activities form an important part of the
38 economy of the ROI. In 2007, 202,663 people were employed in the ROI in the various sectors
39 identified as recreation, constituting 10.3% of total ROI employment (Table 8.2.19.1-14).
40 Recreation spending also produced more than \$4,967 million in income in the ROI in 2007.
41 The primary sources of recreation-related employment were eating and drinking places.

42 43 44 **8.2.19.2 Impacts**

45
46 The following analysis begins with a description of the common impacts of solar
47 development, including common impacts on recreation and on social change. These impacts

TABLE 8.2.19.1-14 Recreation Sector Activity in the Proposed Bullard Wash SEZ ROI, 2007

ROI	Employment	Income (\$ million)
Amusement and recreation services	20,573	234.3
Automotive rental	4,855	233.8
Eating and drinking places	146,639	3,048.4
Hotels and lodging places	20,573	742.0
Museums and historic sites,	1,047	59.8
Recreational vehicle parks and campsites	1,667	50.7
Scenic tours	6,934	367.0
Sporting goods retailers	11,691	231.0
Total ROI	202,663	4,967.1

Source: MIG, Inc. (2010).

would occur regardless of the solar technology developed in the SEZ. The impacts of facilities employing various solar energy technologies are analyzed in detail in subsequent sections.

8.2.19.2.1 Common Impacts

Construction and operation of a solar energy facility at the proposed SEZ would produce direct and indirect economic impacts. Direct impacts would occur as a result of expenditures on wages and salaries, procurement of goods and services required for project construction and operation, and the collection of state sales and income taxes. Indirect impacts would occur as project wages and salaries, procurement expenditures, and tax revenues subsequently circulate through the economy of each state, thereby creating additional employment, income, and tax revenues. Facility construction and operation would also require in-migration of workers and their families into the ROI surrounding the site, which would affect population, rental housing, health service employment, and public safety employment. Socioeconomic impacts common to all utility-scale solar energy facilities are discussed in detail in Section 5.17. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2.

Recreation Impacts

Estimating the impact of solar facilities on recreation is problematic because it is not clear how solar development in the SEZ would affect recreational visitation and nonmarket values (i.e., the value of recreational resources for potential or future visits; see Appendix M). While it is clear that some land in the ROI would no longer be accessible for recreation, the majority of popular recreational locations would be precluded from solar development. It is also

1 possible that solar development in the ROI would be visible from popular recreation locations,
2 and that construction workers residing temporarily in the ROI would occupy accommodations
3 otherwise used for recreational visits, thus reducing visitation and consequently affecting the
4 economy of the ROI.

6 **Social Change**

8 Although an extensive literature in sociology documents the most significant components
9 of social change in energy boomtowns, the nature and magnitude of the social impact of energy
10 developments in small rural communities are still unclear (see Section 5.17.1.1.4). While some
11 degree of social disruption is likely to accompany large-scale in-migration during the boom
12 phase, there is insufficient evidence to predict the extent to which specific communities are
13 likely to be affected, which population groups within each community are likely to be most
14 affected, and the extent to which social disruption is likely to persist beyond the end of the boom
15 period (Smith et al. 2001). Accordingly, because of the lack of adequate social baseline data, it
16 has been suggested that social disruption is likely to occur once an arbitrary population growth
17 rate associated with solar energy projects has been reached, with an annual rate of between
18 5 and 10% growth in population assumed to result in a breakdown in social structures; a
19 consequent increase in alcoholism, depression, suicide, social conflict, divorce, delinquency;
20 and deterioration in levels of community satisfaction (BLM 1980, 1983, 1996).

22 In overall terms, the in-migration of workers and their families into the ROI would
23 represent an increase of less than 0.1% in ROI population during construction of the trough
24 technology, with smaller increases for the power tower, dish engine and PV technologies,
25 and during the operation of each technology. While it is possible that some construction and
26 operations workers will choose to locate in communities closer to the SEZ, the lack of available
27 housing in smaller rural communities in the ROI to accommodate all in-migrating workers and
28 families, and an insufficient range of housing choices to suit all solar occupations, make it likely
29 that many workers would commute to the SEZ from larger communities elsewhere in the ROI,
30 reducing the potential impact of solar development on social change. Regardless of the pace of
31 population growth associated with the commercial development of solar resources, and the
32 likely residential location of in-migrating workers and families in communities some distance
33 from the SEZ itself, the number of new residents from outside the ROI is likely to lead to some
34 demographic and social change in small rural communities in the ROI. Communities hosting
35 solar developments are likely to be required to adapt to a different quality of life, with a
36 transition away from a more traditional lifestyle involving ranching and taking place in small,
37 isolated, close-knit, homogenous communities with a strong orientation toward personal and
38 family relationships, toward a more urban lifestyle, with increasing cultural and ethnic diversity
39 and increasing dependence on formal social relationships within the community.

42 **Livestock Grazing Impacts**

44 Cattle ranching and farming supported 1,408 jobs, and \$21.1 million in income in the
45 ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed
46 Bullard Wash SEZ could result in a decline in the amount of land available for livestock grazing,

1 resulting in total (direct plus indirect) impacts of the loss of 13 jobs and less than \$0.3 million in
2 income in the ROI. There would also be a decline in grazing fees payable to the BLM and to the
3 USFS by individual permittees based on the number of AUMs required to support livestock on
4 public land. Assuming the 2008 fee of \$1.35 per AUM, grazing fee losses would amount to
5 \$439 annually on land dedicated to solar facilities in the SEZ.
6
7

8 **Transmission Line Impacts**

9

10 The impacts of transmission line construction could include the addition of 27 jobs in the
11 ROI (including direct and indirect impacts) in the peak year of construction (Table 8.2.19.2-1).
12 Construction activities in the peak year would constitute less than 1% of total ROI employment.
13 A transmission line would also produce \$1.4 million in ROI income. Direct sales taxes and direct
14 income taxes would be less than \$0.1 million.
15

16 Given the likelihood of local worker availability in the required occupational categories,
17 construction of a transmission line would mean that some in-migration of workers and their
18 families from outside the ROI would be required, with 10 persons in-migrating into the ROI
19 during the peak construction year. Although in-migration may potentially affect local housing
20 markets, the relatively small number of in-migrants and the availability of temporary
21 accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar
22 facility construction on the number of vacant rental housing units is not expected to be large,
23 with five rental units expected to be occupied in the ROI. This occupancy rate would represent
24 less than 1% of the vacant rental units expected to be available in the ROI in the peak year.
25

26 No new community service employment would be required in order to meet existing
27 levels of service in the three-county ROI.
28

29 Total operations employment impacts in the ROI (including direct and indirect impacts)
30 of a transmission line would be one job during the first year of operation (Table 8.2.19.2-2) and
31 would also produce less than \$0.1 million in income. Direct sales taxes would be less than
32 \$0.1 million in the first year, and direct income taxes, less than \$0.1 million. Operation of a
33 transmission line would not require the in-migration of workers and their families from outside
34 the ROI; consequently, no impacts on housing markets in the ROI would be expected, and no
35 new community service employment would be required in order to meet existing levels of
36 service in the ROI.
37
38

39 **Access Road Impacts**

40

41 The impacts of construction of an access road connecting the proposed Bullard Wash
42 SEZ could include the addition of 122 jobs in the ROI (including direct and indirect impacts)
43 in the peak year of construction (Table 8.2.19.2-2). Construction activities in the peak year
44 would constitute less than 1% of total ROI employment. Access road construction would also

TABLE 8.2.19.2-1 ROI Socioeconomic Impacts of a 230-kV Transmission Line at the Proposed Bullard Wash SEZ^a

Parameter	Maximum Annual Construction Impacts	Operations
Employment (no.)		
Direct	10	<1
Total	27	1
Income ^b		
Total	1.4	<0.1
Direct state taxes ^b		
Sales	<0.1	<0.1
Income	<0.1	<0.1
In-migrants (no.)	10	0
Vacant housing ^c (no.)	5	0
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts assume 5 mi (8 km) of transmission line are required for the SEZ. Construction impacts are assessed for the peak year of construction.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

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produce \$4.7 million in ROI income. Direct sales taxes and direct income taxes would each be \$0.1 million.

Total operations (maintenance) employment impacts in the ROI (including direct and indirect impacts) of an access road would be less than one job during the first year of operation (Table 11.2.19.2-3) and would also produce less than \$0.1 million in income. Direct sales taxes would be less than \$0.1 million in the first year, and direct income taxes, less than \$0.1 million.

Construction and operation of an access road would not require the in-migration of workers and their families from outside the ROI; consequently, no impacts on housing markets

TABLE 8.2.19.2-2 ROI Socioeconomic Impacts of an Access Road Connecting the Proposed Bullard Wash SEZ^a

Parameter	Maximum Annual Construction Impacts	Operations
Employment (no.)		
Direct	61	<1
Total	122	<1
Income ^b		
Total	4.7	<0.1
Direct state taxes ^b		
Sales	0.1	<0.1
Income	0.1	<0.1
In-migrants (no.)	0	0
Vacant housing ^c (no.)	0	0
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts assume 5 mi (8 km) of access road are required for the SEZ. Construction impacts are assessed for the peak year of construction.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1
2
3 in the ROI would be expected, and no new community service employment would be required
4 in order to meet existing levels of service in the ROI.

5
6
7 **8.2.19.2.2 Technology-Specific Impacts**

8
9 The economic impacts of solar energy development in the proposed SEZ were measured
10 in terms of employment, income, state tax revenues (sales and income), population in-migration,
11 housing, and community service employment (education, health, and public safety). More
12 information on the data and methods used in the analysis can be found in Appendix M.

13
14 The assessment of the impact of the construction and operation of each technology was
15 based on SEZ acreage, assuming 80% of the area could be developed. To capture a range of

1 possible impacts, solar facility size was estimated on the basis of the land requirements of
2 various solar technologies, assuming that 9 acres/MW (0.04 km²/MW) would be required for
3 power tower, dish engine, and PV technologies and 5 acres/MW (0.02 km²/MW) for solar
4 trough technologies. Impacts of multiple facilities employing a given technology at each SEZ
5 were assumed to be the same as impacts for a single facility with the same total capacity.
6 Construction impacts were assessed for a representative peak year of construction, assumed to
7 be 2021 for each technology. Construction impacts assumed that a maximum of one project
8 could be constructed within a given year, with a corresponding maximum land disturbance of
9 up to 3,000 acres (12 km²). For operations impacts, a representative first year of operations was
10 assumed to be 2023 for trough and power tower and 2022 for the minimum facility size for dish
11 engine and PV. The years of construction and operations were selected as representative of the
12 entire 20-year study period because they are the approximate midpoint; construction and
13 operations could begin earlier.

14 15 16 **Solar Trough** 17 18

19 **Construction.** Total construction employment impacts in the ROI (including direct
20 and indirect impacts) from the use of solar trough technologies would be up to 5,477 jobs
21 (Table 8.2.19.2-3). Construction activities would constitute 0.2% of total ROI employment.
22 A solar facility would also produce \$338.5 million in income. Direct sales taxes would be
23 \$13.7 million, and direct income taxes, \$6.3 million.

24
25 Given the scale of construction activities and the likelihood of local worker availability
26 in the required occupational categories, construction of a solar facility would mean that some
27 in-migration of workers and their families from outside the ROI would be required, with
28 743 persons in-migrating into the ROI. Although in-migration may potentially affect local
29 housing markets, the relatively small number of in-migrants and the availability of temporary
30 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
31 construction on the number of vacant rental housing units would not be expected to be large,
32 with 371 rental units expected to be occupied in the ROI. This occupancy rate would represent
33 0.2% of the vacant rental units expected to be available in the ROI.

34
35 In addition to the potential impact on housing markets, in-migration would affect
36 community service employment (education, health, and public safety). An increase in such
37 employment would be required to meet existing levels of service in the ROI. Accordingly,
38 11 new teachers, 4 physicians, and 1 public safety employee (career firefighters and uniformed
39 police officers) would be required in the ROI. These increases would represent less than 0.1%
40 of total ROI employment expected in these occupations.

41
42
43 **Operations.** Total operations employment impacts in the ROI (including direct
44 and indirect impacts) of a build-out using solar trough technologies would be 414 jobs
45 (Table 8.2.19.2-3). Such a solar facility would also produce \$16.2 million in income.
46 Direct sales taxes would be \$0.2 million, and direct income taxes, \$0.4 million. Based on

TABLE 8.2.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Bullard Wash SEZ with Trough Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	1,744	252
Total	5,477	414
Income ^b		
Total	338.5	16.2
Direct state taxes ^b		
Sales	13.7	0.2
Income	6.3	0.4
BLM payments (\$ million 2008)		
Rental	NA ^d	0.5
Capacity ^e	NA	7.6
In-migrants (no.)	743	32
Vacant housing ^c (no.)	371	29
Local community service employment		
Teachers (no.)	11	0
Physicians (no.)	4	0
Public safety (no.)	1	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 600 MW (corresponding to 3,000 acres [12 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 1,158 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

^d Not applicable.

^e The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010f), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

1 fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010f), acreage
2 rental payments would be \$0.5 million, and solar generating capacity payments, at least
3 \$7.6 million.
4

5 Given the likelihood of local worker availability in the required occupational categories,
6 operation of a solar facility would mean that some in-migration of workers and their families
7 from outside the ROI would be required, with 32 persons in-migrating into the ROI. Although
8 in-migration may potentially affect local housing markets, the relatively small number of
9 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home
10 parks) mean that the impact of solar facility operation on the number of vacant owner-occupied
11 housing units would not be expected to be large, with 29 owner-occupied units expected to be
12 occupied in the ROI.
13

14 No new community service employment would be required to meet existing levels of
15 service in the ROI.
16

17 **Power Tower**

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20
21 **Construction.** Total construction employment impacts in the ROI (including direct
22 and indirect impacts) from the use of power tower technologies would be up to 2,182 jobs
23 (Table 8.2.19.2-4). Construction activities would constitute 0.1% of total ROI employment.
24 Such a solar facility would also produce \$134.8 million in income. Direct sales taxes would
25 be less than \$5.5 million; direct income taxes, \$2.5 million.
26

27 Given the scale of construction activities and the likelihood of local worker availability
28 in the required occupational categories, construction of a solar facility would mean that some
29 in-migration of workers and their families from outside the ROI would be required, with
30 296 persons in-migrating into the ROI. Although in-migration may potentially affect local
31 housing markets, the relatively small number of in-migrants and the availability of temporary
32 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
33 construction on the number of vacant rental housing units would not be expected to be large,
34 with 148 rental units expected to be occupied in the ROI. This occupancy rate would represent
35 0.1% of the vacant rental units expected to be available in the ROI.
36

37 In addition to the potential impact on housing markets, in-migration would affect
38 community service (education, health, and public safety) employment. An increase in such
39 employment would be required to meet existing levels of service in the ROI. Accordingly, 5 new
40 teachers, 2 physicians, and 1 public safety employee (career firefighters and uniformed police
41 officers) would be required in the ROI. These increases would represent less than 0.1% of total
42 ROI employment expected in these occupations.
43
44

45 **Operations.** Total operations employment impacts in the ROI (including direct
46 and indirect impacts) of a build-out using power tower technologies would be 184 jobs

TABLE 8.2.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Bullard Wash SEZ with Power Tower Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	695	130
Total	2,182	184
Income ^b		
Total	134.8	6.5
Direct state taxes ^b		
Sales	5.5	<0.1
Income	2.5	0.2
BLM payments (\$ million 2008)		
Rental	NA ^d	0.5
Capacity ^e	NA	4.2
In-migrants (no.)	296	17
Vacant housing ^c (no.)	148	15
Local community service employment		
Teachers (no.)	5	0
Physicians (no.)	2	0
Public safety (no.)	1	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 643 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

^d Not applicable.

^e The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010f), assuming a solar facility with no storage capability and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

1 (Table 8.2.19.2-5). Such a solar facility would also produce \$6.5 million in income. Direct
2 sales taxes would be less than \$0.1 million, and direct income taxes, \$0.2 million. Based on fees
3 established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010f), acreage rental
4 payments would be \$0.5 million, and solar generating capacity payments, at least \$4.2 million.
5

6 Given the likelihood of local worker availability in the required occupational categories,
7 operation of a solar facility means that some in-migration of workers and their families from
8 outside the ROI would be required, with 17 persons in-migrating into the ROI. Although
9 in-migration may potentially affect local housing markets, the relatively small number of
10 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home
11 parks) mean that the impact of solar facility operation on the number of vacant owner-occupied
12 housing units would not be expected to be large, with 15 owner-occupied units expected to be
13 required in the ROI.
14

15 No new community service employment would be required to meet existing levels of
16 service in the ROI.
17

18 **Dish Engine**

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21
22 **Construction.** Total construction employment impacts in the ROI (including direct
23 and indirect impacts) from the use of dish engine technologies would be up to 1,029 jobs
24 (Table 8.2.19.2-5). Construction activities would constitute less than 0.1% of total ROI
25 employment. Such a solar facility would also produce \$60.8 million in income. Direct
26 sales taxes would be less than \$2.2 million, and direct income taxes, \$1.0 million.
27

28 Given the scale of construction activities and the likelihood of local worker availability
29 in the required occupational categories, construction of a solar facility would mean that some
30 in-migration of workers and their families from outside the ROI would be required, with
31 120 persons in-migrating into the ROI. Although in-migration may potentially affect local
32 housing markets, the relatively small number of in-migrants and the availability of temporary
33 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
34 construction on the number of vacant rental housing units would not be expected to be large,
35 with 60 rental units expected to be occupied in the ROI. This occupancy rate would represent
36 less than 0.1% of the vacant rental units expected to be available in the ROI.
37

38 In addition to the potential impact on housing markets, in-migration would affect
39 community service (education, health, and public safety) employment. An increase in such
40 employment would be required to meet existing levels of service in the ROI. Accordingly, 2 new
41 teachers and 1 physician would be required in the ROI. These increases would represent less than
42 0.1% of total ROI employment expected in these occupations.
43
44

45 **Operations.** Total operations employment impacts in the ROI (including direct
46 and indirect impacts) of a build-out using dish engine technologies would be 179 jobs

TABLE 8.2.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Bullard Wash SEZ with Dish Engine Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	282	127
Total	1,029	179
Income ^b		
Total	60.8	6.3
Direct state taxes ^b		
Sales	2.2	<0.1
Income	1.0	0.2
BLM payments (\$ million 2008)		
Rental	NA ^d	0.5
Capacity ^e	NA	4.2
In-migrants (no.)	120	16
Vacant housing ^c (no.)	60	15
Local community service employment		
Teachers (no.)	2	0
Physicians (no.)	1	0
Public safety (no.)	0	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 643 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

^d Not applicable.

^e The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010f), assuming a solar facility with no storage capability and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

1 (Table 8.2.19.2-5). Such a solar facility would also produce less than \$6.3 million in income.
2 Direct sales taxes would be less than \$0.1 million, and direct income taxes, \$0.2 million. Based
3 on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010f), acreage
4 rental payments would be \$0.5 million, and solar generating capacity payments, at least
5 \$4.2 million.
6

7 Given the likelihood of local worker availability in the required occupational categories,
8 operation of a dish engine solar facility means that some in-migration of workers and their
9 families from outside the ROI would be required, with 16 persons in-migrating into the ROI.
10 Although in-migration may potentially affect local housing markets, the relatively small number
11 of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile
12 home parks) mean that the impact of solar facility operation on the number of vacant owner-
13 occupied housing units would not be expected to be large, with 15 owner-occupied units
14 expected to be required in the ROI.
15

16 No new community service employment would be required to meet existing levels of
17 service in the ROI.
18
19

20 **Photovoltaic**

21
22

23 **Construction.** Total construction employment impacts in the ROI (including direct and
24 indirect impacts) from the use of PV technologies would be up to 480 jobs (Table 8.2.19.2-6).
25 Construction activities would constitute less than 0.1% of total ROI employment. Such a solar
26 development would also produce \$28.4 million in income. Direct sales taxes would be
27 \$1.0 million, and direct income taxes, \$0.5 million.
28

29 Given the scale of construction activities and the likelihood of local worker availability
30 in the required occupational categories, construction of a solar facility would mean that some
31 in-migration of workers and their families from outside the ROI would be required, with
32 56 persons in-migrating into the ROI. Although in-migration may potentially affect local
33 housing markets, the relatively small number of in-migrants and the availability of temporary
34 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
35 construction on the number of vacant rental housing units would not be expected to be large,
36 with 28 rental units expected to be occupied in the ROI. This occupancy rate would represent
37 less than 0.1% of the vacant rental units expected to be available in the ROI.
38

39 In addition to the potential impact on housing markets, in-migration would affect
40 community service (education, health, and public safety) employment. An increase in such
41 employment would be required to meet existing levels of service in the ROI. Accordingly,
42 1 new teacher would be required in the ROI. This increase would represent less than 0.1%
43 of total ROI employment expected in this occupation.
44
45

46 **Operations.** Total operations employment impacts in the ROI (including direct and
47 indirect impacts) of a build-out using PV technologies would be 18 jobs (Table 8.2.19.2-6).

TABLE 8.2.19.2-6 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Bullard Wash SEZ with PV Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	132	13
Total	480	18
Income ^b		
Total	28.4	0.6
Direct state taxes ^b		
Sales	1.0	<0.1
Income	0.5	<0.1
BLM payments (\$ million 2008)		
Rental	NA ^d	0.5
Capacity ^e	NA	3.4
In-migrants (no.)	56	2
Vacant housing ^c (no.)	28	1
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 643 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

^d Not applicable

^e The BLM annual capacity payment was based on a fee of \$5,256 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010f), assuming full build-out of the site.

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1 Such a solar facility would also produce \$0.6 million in income. Direct sales taxes would be less
2 than \$0.1 million, and direct income taxes, less than \$0.1 million. Based on fees established by
3 the BLM in its Solar Energy Interim Rental Policy (BLM 2010f), acreage rental payments would
4 be \$0.5 million, and solar generating capacity payments, at least \$3.4 million.
5

6 Given the likelihood of local worker availability in the required occupational categories,
7 operation of a solar facility would mean that some in-migration of workers and their families
8 from outside the ROI would be required, with 2 persons in-migrating into the ROI. Although
9 in-migration may potentially affect local housing markets, the relatively small number of
10 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home
11 parks) mean that the impact of solar facility operation on the number of vacant owner-occupied
12 housing units would not be expected to be large, with 1 owner-occupied unit expected to be
13 required in the ROI.
14

15 No new community service employment would be required to meet existing levels of
16 service in the ROI.
17

18 **8.2.19.3 SEZ-Specific Design Features and Design Feature Effectiveness**

19 No SEZ-specific design features addressing socioeconomic impacts have been identified
20
21 No SEZ-specific design features addressing socioeconomic impacts have been identified
22 for the proposed Bullard Wash SEZ. Implementing the programmatic design features described
23 in Appendix A, Section A.2.2, as required under BLM’s Solar Energy Program, would reduce
24 the potential for socioeconomic impacts during all project phases.
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1 **8.2.20 Environmental Justice**

2
3
4 **8.2.20.1 Affected Environment**

5
6 On February 11, 1994, the President signed Executive Order 12898 “Federal Actions to
7 Address Environmental Justice in Minority Populations and Low-Income Populations,” which
8 formally requires federal agencies to incorporate environmental justice as part of their missions
9 (*Federal Register*, Volume 59, page 76297, Feb. 11, 1994). Specifically, it directs them to
10 address, as appropriate, any disproportionately high and adverse human health or environmental
11 effects of their actions, programs, or policies on minority and low-income populations.
12

13 The analysis of the impacts of solar energy projects on environmental justice issues
14 follows guidelines described in the Council on Environmental Quality’s (CEQ’s) Environmental
15 Justice Guidance under the National Environmental Policy Act (CEQ 1997). The analysis
16 method has three parts: (1) a description of the geographic distribution of low-income and
17 minority populations in the affected area is undertaken; (2) an assessment is conducted to
18 determine whether construction and operation would produce impacts that are high and adverse;
19 and (3) if impacts are high and adverse, a determination is made as to whether these impacts
20 disproportionately affect minority and low-income populations.
21

22 Construction and operation of solar energy projects in the proposed SEZ could affect
23 environmental justice if any adverse health and environmental impacts resulting from either
24 phase of development are significantly high and if these impacts disproportionately affect
25 minority and low-income populations. If the analysis determines that health and environmental
26 impacts are not significant, there can be no disproportionate impacts on minority and low-income
27 populations. In the event impacts are significant, disproportionality would be determined by
28 comparing the proximity of any high and adverse impacts with the location of low-income and
29 minority populations.
30

31 The analysis of environmental justice issues associated with the development of solar
32 facilities considered impacts within the SEZ and an associated 50-mi (80-km) radius around the
33 boundary of the SEZ. A description of the geographic distribution of minority and low-income
34 groups in the affected area was based on demographic data from the 2000 Census (U.S. Bureau
35 of the Census 2009k,1). The following definitions were used to define minority and low-income
36 population groups:
37

- 38 • **Minority.** Persons who identify themselves as belonging to any of the
39 following racial groups: (1) Hispanic, (2) Black (not of Hispanic origin)
40 or African American, (3) American Indian or Alaska Native, (4) Asian,
41 or (5) Native Hawaiian or Other Pacific Islander.
42

43 Beginning with the 2000 Census, where appropriate, the census form allows
44 individuals to designate multiple population group categories to reflect their
45 ethnic or racial origin. In addition, persons who classify themselves as being
46 of multiple racial origins may choose up to six racial groups as the basis of

1 their racial origins. The term minority includes all persons, including those
2 classifying themselves in multiple racial categories, except those who
3 classify themselves as not of Hispanic origin and as White or “Other Race”
4 (U.S. Bureau of the Census 2009k).

5
6 The CEQ guidance proposed that minority populations should be identified
7 where either (1) the minority population of the affected area exceeds 50% or
8 (2) the minority population percentage of the affected area is meaningfully
9 greater than the minority population percentage in the general population or
10 other appropriate unit of geographic analysis.

11
12 This PEIS applies both criteria in using the Census data for census block
13 groups, wherein consideration is given to the minority population that is
14 both greater than 50% and 20 percentage points higher than in the state
15 (the reference geographic unit).

- 16
17 • **Low-Income.** Individuals who fall below the poverty line. The poverty line
18 takes into account family size and age of individuals in the family. In 1999,
19 for example, the poverty line for a family of five with three children below
20 the age of 18 was \$19,882. For any given family below the poverty line, all
21 family members are considered as being below the poverty line for the
22 purposes of analysis (U.S. Bureau of the Census 2009I).

23
24 The data in Table 8.2.20.1-1 show the minority and low-income composition of total
25 population located in the proposed SEZ based on 2000 Census data and CEQ guidelines.
26 Individuals identifying themselves as Hispanic or Latino are included in the table as a separate
27 entry. However, because Hispanics can be of any race, this number also includes individuals
28 identifying themselves as being part of one or more of the population groups listed in the table.

29
30 A large number of minority and low-income individuals are located in the 50-mi (80-km)
31 area around the boundary of the SEZ. Within the 50-mi (80-km) radius, 14.3% of the population
32 is classified as minority, while 12.7% is classified as low-income. The number of minority
33 individuals does not exceed 50% of the total population in the area and the number of minority
34 individuals does not exceed the state average by 20 percentage points or more; thus, there is
35 no minority population in the SEZ area based on 2000 Census data and CEQ guidelines. The
36 number of low-income individuals does not exceed the state average by 20 percentage points or
37 more and does not exceed 50% of the total population in the area; thus, there are no low-income
38 populations in the SEZ.

39
40 Figures 8.2.20.1-1 and 8.2.20.1-2 show the locations of the minority and low-income
41 population groups, respectively, within the 50-mi (80-km) radius around the boundary of the
42 SEZ.

43
44 At the individual block group level there are census block groups where the minority
45 population exceeds the state average by more than 20 percentage points to the south of the SEZ,
46

TABLE 8.2.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Bullard Wash SEZ

Parameter	Arizona
Total population	106,692
White, non-Hispanic	91,403
Hispanic or Latino	11,859
Non-Hispanic or Latino minorities	3,430
One race	2,199
Black or African American	474
American Indian or Alaskan Native	1,072
Asian	502
Native Hawaiian or Other Pacific Islander	64
Some other race	87
Two or more races	1,231
Total minority	15,289
Low-income	13,201
Percentage minority	14.3
State percentage minority	24.5
Percentage low-income	12.7
State percentage low-income	13.9

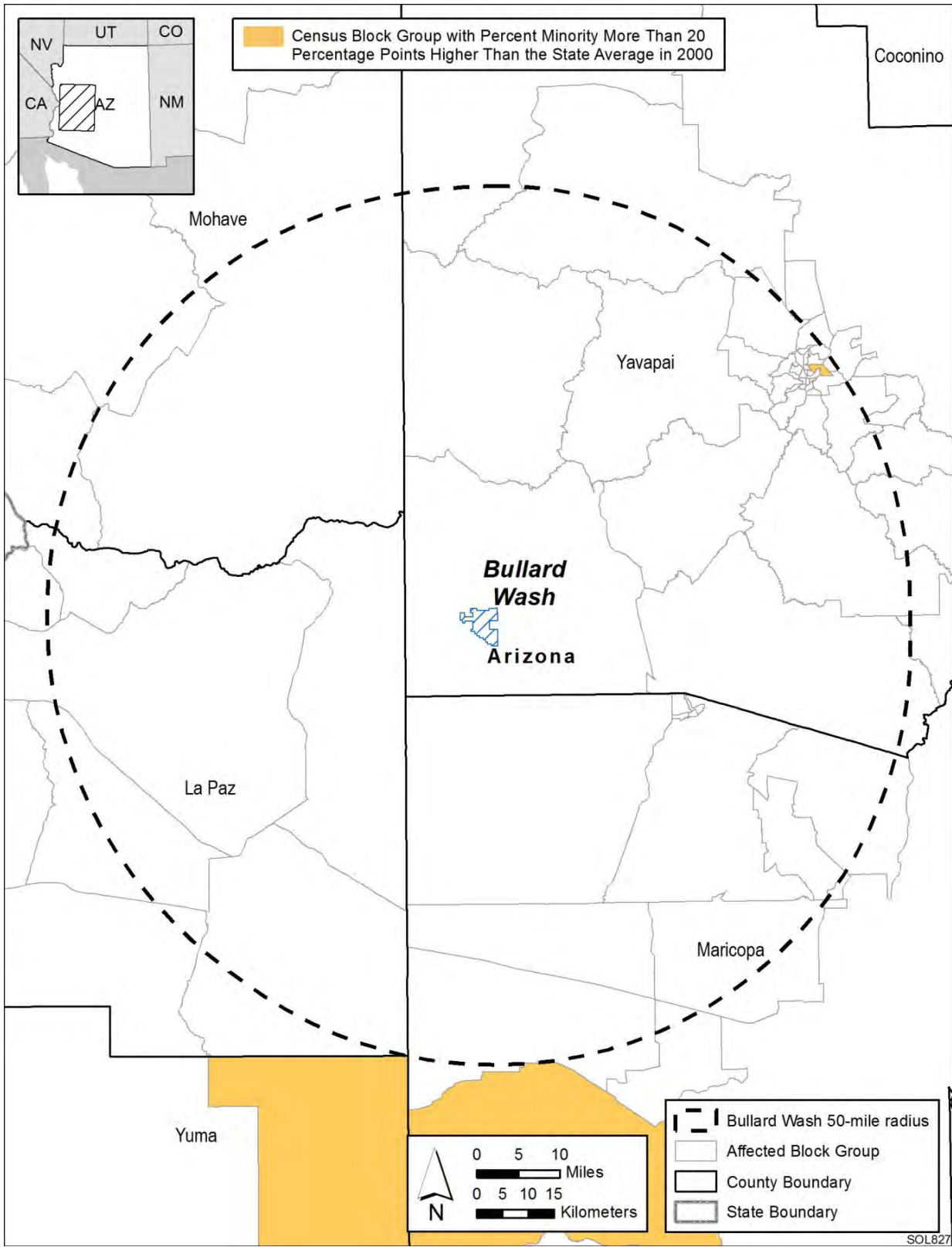
Source: U.S Bureau of the Census (2009k,l).

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2
3 and to the northeast of the site, in the city of Prescott. There are no block groups in which the
4 minority population exceeds 50% of the total population.
5

6 There is one census block group located to the southwest of the SEZ with a low-income
7 population which is more than 20 percentage points higher than the state average. There are no
8 census block groups in which the low-income population exceeds 50% of the total population.
9

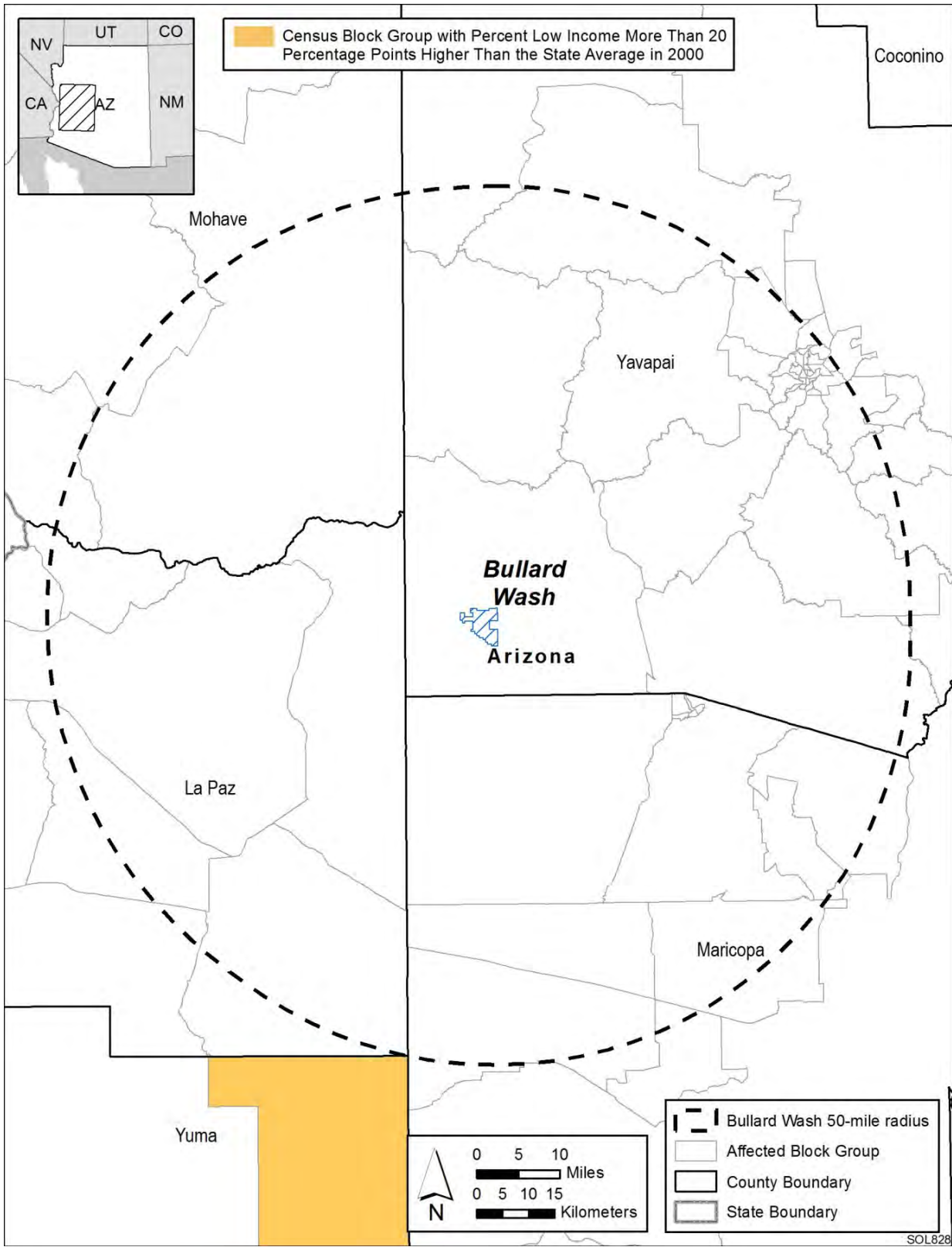
10
11 **8.2.20.2 Impacts**
12

13 Environmental justice concerns common to all utility-scale solar energy facilities are
14 described in detail in Section 5.18. These impacts will be minimized through the implementation
15 of the programmatic design features described in Appendix A, Section A.2.2, which address
16 the underlying environmental impacts contributing to the concerns. The potentially relevant
17 environmental impacts associated with solar facilities within the proposed Bullard Wash SEZ
18 include noise and dust during the construction; noise and electromagnetic field (EMF) effects



1

2 **FIGURE 8.2.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding**
 3 **the Proposed Bullard Wash SEZ**



1

2 **FIGURE 8.2.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius**
 3 **Surrounding the Proposed Bullard Wash SEZ**

1 associated with operations; visual impacts of solar generation and auxiliary facilities, including
2 transmission lines; access to land used for economic, cultural, or religious purposes; and effects
3 on property values as areas of concern that might potentially affect minority and low-income
4 populations. Minority populations have been identified within 50 mi (80 km) of the proposed
5 Bullard Wash SEZ; no low-income populations are present (Section 8.2.20.1).
6

7 Potential impacts on low-income and minority populations could be incurred as a result
8 of the construction and operation of solar facilities involving each of the four technologies.
9 Although impacts are likely to be small, there are minority populations defined by CEQ
10 guidelines (Section 8.2.20.1) within the 50-mi (80-km) radius around the boundary of the SEZ;
11 meaning that any adverse impacts of solar projects could not disproportionately affect minority
12 populations. Because there are low-income populations within the 50-mi (80-km) radius, there
13 could be impacts on low-income populations.
14

15 **8.2.20.3 SEZ-Specific Design Features and Design Feature Effectiveness** 16

17
18 No SEZ-specific design features addressing socioeconomic impacts have been identified
19 for the proposed Bullard Wash SEZ. Implementing the programmatic design features described
20 in Appendix A, Section A.2.2, as required under BLM's proposed Solar Energy Program, would
21 reduce the potential for environmental justice impacts during all project phases.
22
23

1 **8.2.21 Transportation**
2

3 The proposed Bullard Wash SEZ is accessible by road and by rail. Two U.S. highways
4 serve the immediate area, as do a regional railroad, a major railroad, a number of small airports,
5 and one large airport. General transportation considerations and impacts are discussed in
6 Sections 3.4 and 5.19, respectively.
7

8
9 **8.2.21.1 Affected Environment**
10

11 The northeastern tip of the proposed Bullard Wash SEZ lies about 5.5 mi (8.9 km) from
12 U.S. 93, which runs in a general northwest to southeast direction, as shown in Figure 8.2.21.1-1,
13 with I-40 about 86 mi (138 km) northwest of the SEZ and Wickenburg about 20 mi (32 mi)
14 southeast. U.S. 93 connects with U.S. 60 in Wickenburg, with U.S. 60 continuing for
15 approximately 30 mi (48 km) to the southeast, where it encounters the northwestern edge of the
16 Phoenix metropolitan area. State Route 71 passes approximately 5 mi (8 km) southeast of the
17 southeastern tip of the SEZ and intersects with U.S. 93 just over 10 mi (16 km) due east of the
18 SEZ. State Route 71 connects with U.S. 60 near the small town of Aguila to the south and State
19 Route 89 in Congress to the east. U.S. 60 also passes approximately 10 mi (16 km) south of the
20 Bullard Wash SEZ and passes through Wickenburg, where it turns southeast towards Phoenix.
21 Several local unimproved dirt roads cross the SEZ. The route inventory for the area of the SEZ
22 shows seven inventoried OHV routes within the area of the SEZ (Baker and Bickauskas 2010).
23 As listed in Table 8.2.21.1-1, U.S. 93 carries an average traffic volume of about 6,700 vehicles
24 per day in the vicinity of the Bullard Wash SEZ (ADOT 2010b).
25

26 The ARZC Railroad serves the area (RailAmerica 2010). This regional railroad
27 originates in the west at Cadiz, California, where it has an interchange with the Burlington
28 Northern Santa Fe (BNSF) Railroad. The ARZC Railroad passes into Arizona through Parker
29 and travels southeast to Vicksburg, from which it travels northeast to Matthie (adjacent to
30 Wickenburg [70 mi (113 km)]), where it again has an interchange with the BNSF Railroad. This
31 interchange is about an 18 mi (29 km) drive from the closest approach of U.S. 93 to the Bullard
32 Wash SEZ. The BNSF Railroad runs from Phoenix up through Wickenburg, Matthie, Congress,
33 and other stops on its way northward. The BNSF stop in Congress is closer to the SEZ than the
34 Matthie stop, about 12 mi (19 km) from the closest approach of U.S. 93 to the SEZ.
35

36 Eight small airports and one major airport that are open to the public are within a driving
37 distance of approximately 86 mi (138 km) of the proposed Bullard Wash SEZ, as listed in
38 Table 8.2.21.1-2. The nearest public airport is the Wickenburg Municipal Airport, 22 mi (35 km)
39 southeast of the SEZ. With the exception of Prescott Regional Airport, none of the small airports
40 has regularly scheduled passenger service. Two regional carriers provide direct commercial
41 passenger service from Prescott to Los Angeles, California; Ontario, California; Farmington,
42 New Mexico; Durango, Colorado; and Denver, Colorado (City of Prescott 2010). Phoenix Sky
43 Harbor International Airport is a major airport in Phoenix (86 mi [138 km]) to the east, with
44 passenger service to most major cities in the United States provided by all major and some
45 regional U.S. carriers. Table 8.2.21.1-3 summarizes the commercial passenger and freight traffic
46 with reported values at airports in the vicinity of the Bullard Wash SEZ.

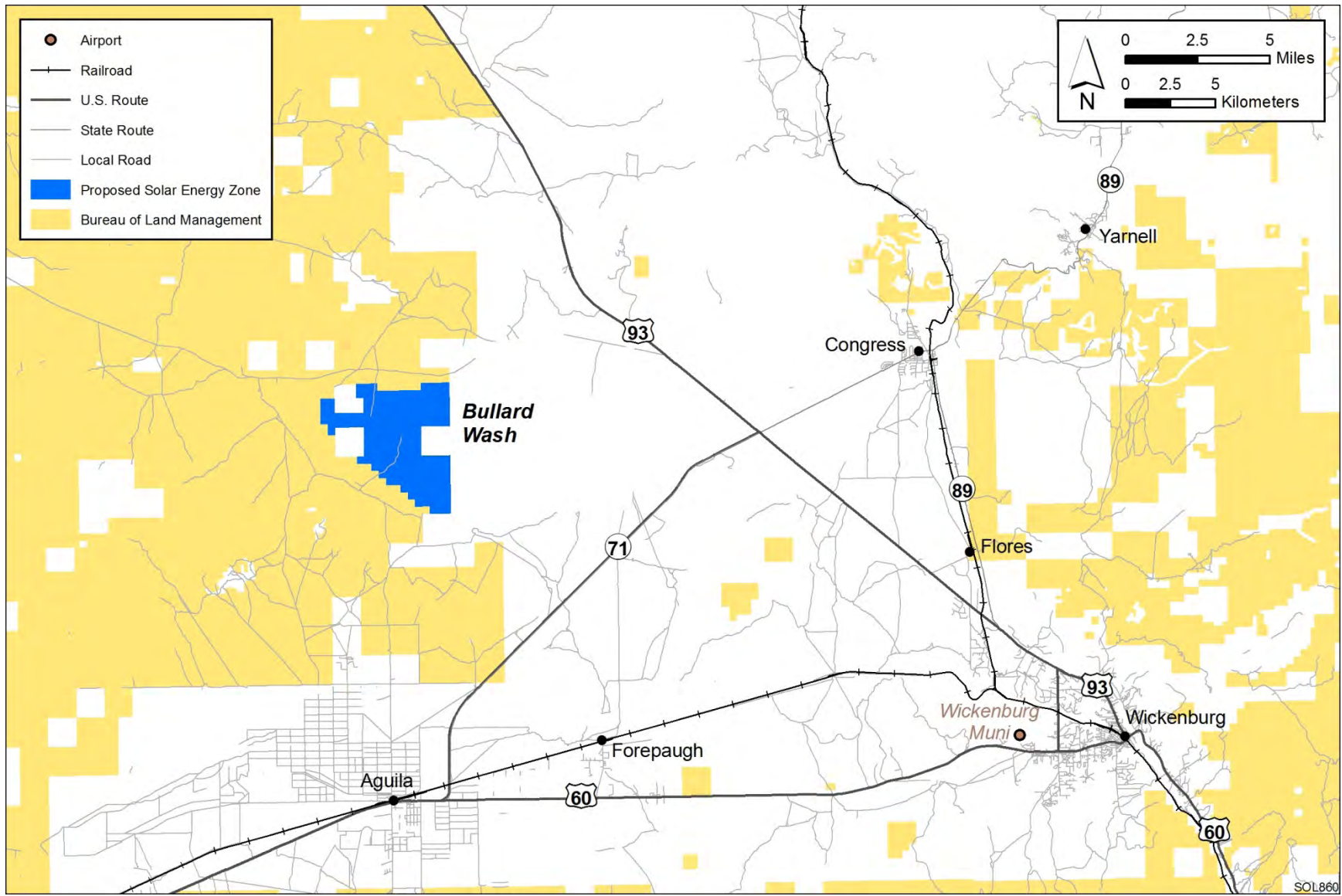


FIGURE 8.2.21.1-1 Local Transportation Network Serving the Proposed Bullard Wash SEZ

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TABLE 8.2.21.1-1 AADT on Major Roads near the Proposed Bullard Wash SEZ for 2008

Road	General Direction	Location	AADT (Vehicles)
U.S. 60	Southwest–northeast (I-10 to Wickenburg), Northwest–southwest (Wickenburg to Phoenix)	I-10 Exit 31 to Vicksburg Road	1,500
		Vicksburg Rd. to State Route 72	1,500
		State Route 72 to Buckeye Road	2,500
		Buckeye Road to 2nd St. (in Wenden)	2,000
		2nd St. (in Wenden) to State Route 71	1,600
		State Route 71 to Wickenburg Airport Rd.	1,600
		Wickenburg Airport Rd. to Vulture Mine Rd.	4,600
		West of U.S. 93 junction	12,500
		East of U.S. 93 junction	20,000
		Northwest of State Route 74	15,000
		Southeast of State Route 74	12,500
		Northwest of Happy Valley Rd.	19,500
Northwest of State Route 303	31,500		
U.S. 93	Northwest–southeast	U.S. 60 to Vulture Mine Rd.	13,500
		Vulture Mine Rd. to State Route 89	9,500
		State Route 89 to State Route 71	6,700
		State Route 71 to State Route 97	6,700
		North of State Route 97	6,400
State Route 71	Southwest–northeast	U.S. 60 to U.S. 93	600
		U.S. 93 to State Route 89	800
State Route 89	North–south	U.S. 93 to State Route 71	3,300
		North of Congress	2,800

Source: ADOT (2010b).

8.2.21.2 Impacts

As discussed in Section 5.19, the primary transportation impacts are anticipated to be from commuting worker traffic. Single projects could involve up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). This volume of traffic on U.S. 93 would represent an increase in traffic of about 30% in the area of the proposed Bullard Wash SEZ. Such traffic levels would represent about a 300% increase of the traffic levels experienced on State Route 71 near the SEZ if all project traffic were to be routed through State Route 71. Because higher traffic volumes would be experienced during shift changes, traffic on U.S. 93 could experience minor slowdowns during these time periods in the area of any junctions with SEZ site access roads. Local road improvements in addition to turn lanes may be necessary on any portion of U.S. 93 near any site access point(s).

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. If there are any routes designated as open within

TABLE 8.2.21.1-2 Airports Open to the Public in the Vicinity of the Proposed Bullard Wash SEZ

Airport	Location	Owner/Operator	Runway 1			Runway 2		
			Length (ft [m])	Type	Condition	Length (ft [m])	Type	Condition
Wickenburg Municipal	In Wickenburg, 22 mi (35 km) southeast off U.S. 60	Town of Wickenburg	6,100 (1,859)	Asphalt	Good	NA ^a	NA	NA
Bagdad	In Bagdad, 42 mi (68 km) north of the SEZ	Yavapai County	4,575 (1,394)	Asphalt	Good	NA	NA	NA
Pleasant Valley	In Peoria, 56 mi (90 km) southeast of the SEZ along U.S. 60 to State Route 74	Pleasant Valley Airport Association	2,400 (732)	Dirt	Excellent	4,200 (1,280)	Dirt	Fair
			4,200 (1,280)	Dirt	Fair	4,200 (1,280)	Dirt	Fair
Glendale Municipal	In Glendale, 64 mi (103 km) southeast of the SEZ near U.S. 60	City of Glendale	7,150 (2,179)	Asphalt	Good	NA	NA	NA
Prescott Municipal (Ernest A. Love Field)	In Prescott, 64 mi (103 km) northeast along State Route 89	City of Prescott	4,408 (1,344)	Asphalt	Good	4,848 (1,748)	Asphalt	Good
			7,616 (2,321)	Asphalt/ porous friction courses	Good	NA	NA	NA
Buckeye Municipal	In Buckeye, 68 mi (109 km) south-southeast on the western edge of the Phoenix metropolitan area	Town of Buckeye	5,500 (1,676)	Asphalt	Good	NA	NA	NA
Phoenix-Deer Valley Municipal	In Deer Valley, 71 mi (114 km) southeast in the Phoenix metropolitan area	City of Phoenix	4,508 (1,374)	Asphalt	Good	8,197 (2,498)	Asphalt	Good
Phoenix Goodyear	In Goodyear, 72 mi (116 km) southeast in the Phoenix metropolitan area	City of Phoenix	8,500 (2,591)	Asphalt	Good	NA	NA	NA

TABLE 8.2.21.1-2 (Cont.)

Airport	Location	Owner/Operator	Runway 1			Runway 2		
			Length (ft [m])	Type	Condition	Length (ft [m])	Type	Condition
Phoenix Sky Harbor International	In Phoenix, 86 mi (138 km) southeast	City of Phoenix	7,800 (2,377)	Concrete/ grooved	Good	10,300 (3,139)	Concrete / grooved	Good
			11,489 (3,502)	Concrete/ grooved	Good	NA	NA	NA

^a NA = not applicable.

Source: FAA (2010).

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TABLE 8.2.21.1-3 Commercial Passenger and Freight Traffic at Airports in the Vicinity of the Proposed Bullard Wash SEZ for 2008

Airport	Passengers ^a		Freight ^a (lb [kg])	
	Arrived	Departed	Arrived	Departed
Wickenburg Municipal	3	2	2,622 (1,189)	1,311 (595)
Glendale Municipal	76	109	0	0
Prescott Regional (Ernest A. Love Field)	11,653	11,872	4,568 (2,072)	185 (84)
Phoenix-Deer Valley Municipal	0	0	5,014 (2,274)	2,507 (1,137)
Phoenix Sky Harbor International	19.5 million	19.5 million	292 million (132 million)	234 million (106 million)

^a Source: BTS (2009).

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the proposed SEZ, open routes crossing areas granted ROWs for solar facilities would be re-designated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

8.2.21.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified related to impacts on transportation systems around the proposed Bullard Wash SEZ. The programmatic design features described in Appendix A, Section A.2.2, including local road improvements, multiple site access locations, staggered work schedules, and ride-sharing, would all provide some relief from traffic congestion on local roads leading to the site. Depending on the location of solar facilities within the SEZ, more specific access locations and local road improvements could be implemented.

1 **8.2.22 Cumulative Impacts**
2

3 The analysis presented in this section addresses the potential cumulative impacts in the
4 vicinity of the proposed Bullard Wash SEZ in Yavapai County, Arizona. The CEQ guidelines
5 for implementing NEPA define cumulative impacts as environment impacts resulting from the
6 incremental impacts of an action when added to other past, present, and reasonably foreseeable
7 future actions (40 CFR 1508.7). The impacts of other actions are considered without regard to
8 the agency (federal or nonfederal), organization, or person that undertakes them. The time frame
9 of this cumulative impacts assessment could appropriately include activities that would occur up
10 to 20 years in the future (the general time frame for PEIS analyses), but little or no information is
11 available for projects that could occur further than 5 to 10 years in the future.
12

13 The land surrounding the proposed Bullard Wash SEZ is undeveloped, with few
14 permanent residents living in the area. The nearest population center is the small community of
15 Aguila (population 1,064 in 2000), located about 10 mi (16 km) south of the SEZ. The town of
16 Wickenburg (population 5,082 in 2000) is located about 25 mi (40 km) east of the SEZ. About
17 14 WAs are located within 50 mi (80 km) of the SEZ to the north, south, east and west. The
18 Prescott National Forest is about 35 mi (56 km) northeast of the SEZ. The Bill Williams River
19 National Wildlife Refuge is about 43 mi (69 km) west of the SEZ, and the Kofa National
20 Wildlife Refuge is about 50 mi (80 km) southwest of the SEZ. The Luke Air Force Auxiliary
21 Field is about 43 mi (69 km) southeast of the SEZ. The Hualapai Reservation is about 50 mi
22 (80 km) northwest of the SEZ, and the Yavapai Reservation is about 50 mi (80 km) northeast
23 of the SEZ. In addition, the Bullard Wash SEZ is located about 45 mi (72 km) northeast of the
24 Brenda SEZ. For some resources the geographic extent of effects of the two SEZs overlap.
25

26 The geographic extent of the cumulative impacts analysis for potentially affected resources
27 near the proposed Bullard Wash SEZ is identified in Section 8.2.22.1. An overview of ongoing
28 and reasonably foreseeable future actions is presented in Section 8.2.22.2. General trends in
29 population growth, energy demand, water availability, and climate change are discussed in
30 Section 8.2.22.3. Cumulative impacts for each resource area are discussed in Section 8.2.22.4.
31
32

33 **8.2.22.1 Geographic Extent of the Cumulative Impacts Analysis**
34

35 The geographic extent of the cumulative impacts analyses for potentially affected
36 resources evaluated near the proposed Bullard Wash SEZ is provided in Table 8.2.22.1-1. The
37 extent of these geographic areas, which define the boundaries encompassing potentially affected
38 resources, may vary based on the nature of the resource being evaluated and the distance at
39 which an impact may occur. (Thus, for example, the evaluation of air quality may have a greater
40 regional extent of impact than visual resources.) The BLM and the USFS administer most of the
41 land around the SEZ. The BLM administers 48% of the lands within a 50-mi (80-km) radius of
42 the SEZ.
43
44

TABLE 8.2.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Bullard Wash SEZ

Resource Area	Geographic Extent
Land Use	Yavapai, Maricopa, La Paz, and Mohave Counties
Specially Designated Areas and Lands with Wilderness Characteristics	Within a 25-mi (40-km) radius of the Bullard Wash SEZ
Rangeland Resources	
Grazing	Grazing allotments within 5 mi (8 km) of the Bullard Wash SEZ
Wild Horses and Burros	A 50-mi (80-km) radius from the center of the Bullard Wash SEZ
Recreation	Yavapai, Maricopa, La Paz, and Mohave Counties
Military and Civilian Aviation	Yavapai, Maricopa, La Paz, and Mohave Counties
Soil Resources	Areas within and adjacent to the Bullard Wash SEZ
Minerals	Yavapai, Maricopa, La Paz, and Mohave Counties
Water Resources	
Surface Water	Bullard Wash, Date Creek, Santa Maria River, Bill Williams River, Lake Alamo
Groundwater	Date Creek basin portion of the Bill Williams groundwater basin
Air Quality and Climate	A 31-mi (50-km) radius from the center of the Bullard Wash SEZ
Vegetation, Wildlife and Aquatic Biota, Special Status Species	A 50-mi (80-km) radius from the center of the Bullard Wash SEZ, including portions of Yavapai, Maricopa, La Paz, and Mohave Counties
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Bullard Wash SEZ
Acoustic Environment (noise)	Areas adjacent to the Bullard Wash SEZ
Paleontological Resources	Areas within and adjacent to the Bullard Wash SEZ
Cultural Resources	Areas within and adjacent to the Bullard Wash SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the SEZ for other properties, such as traditional cultural properties
Native American Concerns	Areas within and adjacent to the Bullard Wash SEZ; viewshed within a 25-mi (40-km) radius of the Bullard Wash SEZ
Socioeconomics	A 50-mi (80-km) radius from the center of the Bullard Wash SEZ
Environmental Justice	A 50-mi (80-km) radius from the center of the Bullard Wash SEZ
Transportation	U.S. Interstate Highway 10; U.S. Highways 60 and 93; State Routes 71 and 89.

1 **8.2.22.2 Overview of Ongoing and Reasonably Foreseeable Future Actions**
2

3 The future actions described below are those that are “reasonably foreseeable;” that is,
4 they have already occurred, are ongoing, are funded for future implementation, or are included
5 in firm near-term plans. Types of proposals with firm near-term plans are as follows:
6

- 7 • Proposals for which NEPA documents are in preparation or finalized;
- 8
- 9 • Proposals in a detailed design phase;
- 10
- 11 • Proposals listed in formal NOIs published in the *Federal Register* or state
12 publications;
- 13
- 14 • Proposals for which enabling legislations has been passed; and
- 15
- 16 • Proposals that have been submitted to federal, state or county regulators to
17 begin a permitting process.
18

19 Projects in the bidding or research phase or that have been put on hold were not included in the
20 cumulative impact analysis.
21

22 The ongoing and reasonably foreseeable future actions described below are grouped
23 into two categories: (1) actions that relate to energy production and distribution, including
24 foreseeable and potential solar energy projects within 50 mi (80 km) of the proposed SEZ
25 (Section 8.2.22.2.1); and (2) other ongoing and reasonably foreseeable actions within this
26 distance, including those related to mining and mineral processing, grazing management,
27 transportation, recreation, water management, and conservation (Section 8.2.22.2.2). Together,
28 these actions and trends have the potential to affect human and environmental receptors within
29 the geographic range of potential impacts over the next 20 years.
30
31

32 **8.2.22.2.1 Energy Production and Distribution**
33

34 In November 2006, the Arizona Corporation Commission adopted final rules to expand
35 the state’s Renewable Energy Standard to 15% by 2025, with 30% of the renewable energy to be
36 derived from distributed energy (DOE 2010).
37

38 No fast-track solar energy projects and no foreseeable wind or geothermal projects
39 have been identified for areas within 50 mi (80 km) of the proposed Bullard Wash SEZ
40 (Table 8.2.22.2-1). Other potential future actions related to renewable energy production and
41 energy distribution are described in the following paragraphs.
42
43

44 **Renewable Energy Development**
45

46 Renewable energy ROW applications are considered in two categories: fast-track and
47 regular-track applications. Fast-track applications, which apply principally to solar energy

TABLE 8.2.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Bullard Wash SEZ^a

Description	Status	Resources Affected	Primary Impact Location
<i>Fast-Track Solar Energy Projects on BLM-Administered Land</i>			
None	NA ^a	NA	NA
<i>Transmission and Distribution Systems</i>			
None	NA	NA	NA

^a NA = not applicable because no projects have been identified.

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facilities, are those applications on public lands for which the environmental review and public participation process is underway and the applications could be approved by December 2010. A fast-track project would be considered foreseeable because the permitting and environmental review processes would be under way. There are no solar fast-track project applications within 50 mi (80 km) of the proposed Bullard Wash SEZ. Regular-track proposals are considered potential future projects but not necessarily foreseeable projects, since not all applications would be expected to be carried to completion. These proposals are discussed in the following section.

Pending Solar Applications on BLM-Administered Lands. Several regular-track ROW applications for solar projects that have been submitted to the BLM would be located within 50 mi (80 km) of the SEZ. Table 8.2.22.2-2 lists the 17 solar projects that had pending applications submitted to BLM as of March 2010 (BLM and USFS 2010b). The locations of these projects are shown in Figure 8.2.22.2-1. There are no pending wind or geothermal ROW applications within this distance.

The likelihood of any of the regular-track application projects actually being developed is uncertain but is generally assumed to be less than that for fast-track applications. The projects are all listed in Table 8.2.22.2-2 for completeness and as an indication of the level of interest in development of solar energy in the region. Some number of these applications would be expected to result in actual projects. Thus, the cumulative impacts of these potential projects are analyzed for their aggregate effects.

8.2.22.2.2 Other Actions

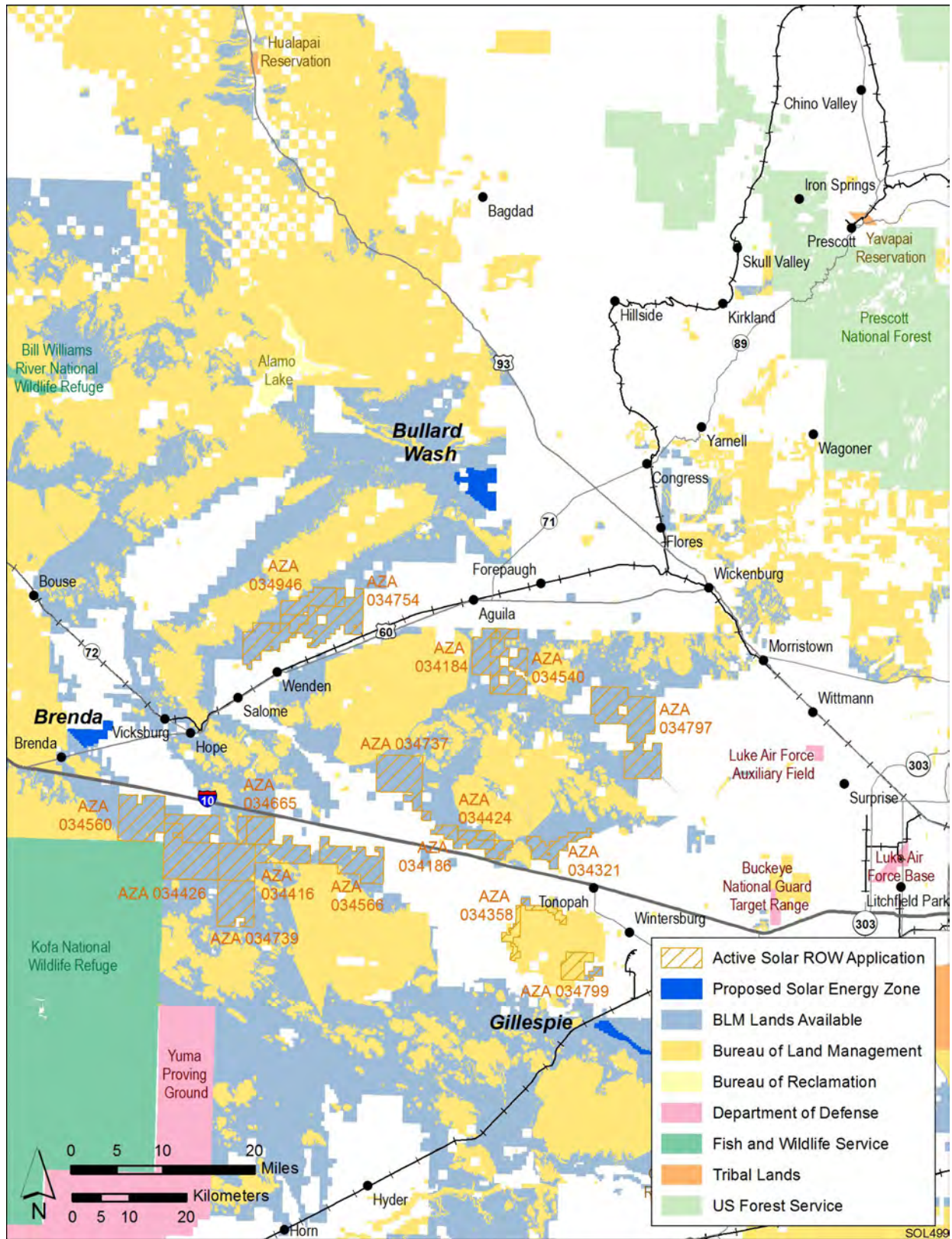
Other major ongoing actions identified within 50 mi (80 km) of the proposed Bullard Wash SEZ are listed in Table 8.2.22.2-3 and are described in the following paragraphs. No other major foreseeable actions have been identified within this distance.

TABLE 8.2.22.2-2 Pending Renewable Energy Project ROW Applications on BLM-Administered Land within 50 mi (80 km) of the Proposed Bullard Wash SEZ^a

Serial No.	Project Name	Application Received	Size (acres ^b)	MW	Technology	Status (NOI date)	Field Office
<i>Solar Applications</i>							
AZA 034184	Boulevard Assoc., LLC (Aguila)	June 26, 2007	7,375	500	CSP/trough	Pending	Hassayampa
AZA 034186	Boulevard Assoc., LLC (Big Horn)	June 26, 2007	6,232	500	CSP/trough	Pending	Hassayampa
AZA 034321	AUSRA AZ II, LLC (Palo Verde)	Oct. 1, 2007	5,748	840	CSP/CLFR	Pending	Hassayampa
AZA 034358	First Solar (Saddle Mtn.)	Nov. 6, 2007	5,997	300	PV	Pending	Lower Sonoran
AZA 034416	Pacific Solar Invst., Inc. (Iberdrola) (Eagle Trail)	Dec. 2, 2007	19,000	1,500	CSP/trough	Pending	Yuma
AZA 034424	Pacific Solar Invst., Inc. (Iberdrola) (Big Horn)	Dec. 4, 2007	13,440	900	CSP	Pending	Hassayampa
AZA 034426	Pacific Solar Invst., Inc. (Iberdrola) (Ranegras)	Dec. 2, 2007	25,860	2,000	CSP/trough	Pending	Yuma
AZA 034540	Horizon Wind Energy, LLC (Aguila)	March 4, 2008	11,535	250	CSP/trough	Pending	Hassayampa
AZA 034560	Nextlight Renewable Power, LLC	March 26, 2008	15,040	500	CSP/trough	Pending	Yuma
AZA 034566	Nextlight Renewable Power, LLC	March 26, 2008	13,428	500	CSP/trough	Pending	Yuma
AZA 034665	Solarreserve, LLC (Black Rack Hill)	May 27, 2008	5,600	600	CSP/tower	Pending	Yuma
AZA 034737	Arizona Solar Invst., Inc. (Haraqahala)	July 10, 2008	14,047	500	CSP/trough	Pending	Hassayampa
AZA 034739	IDIT, Inc.	July 9, 2008	15,000	1,000	CSP/trough	Pending	Yuma
AZA 034754	Horizon Wind Energy, LLC	March 4, 2008	28,760	250	CSP/trough	Pending	Lake Havasu
AZA 034797	LSR Jackrabbit, LLC (Jackrabbit)	Aug. 27, 2008	27,036	500	CSP/tower	Pending	Hassayampa
AZA 034799	LSR Palo Verde, LLC (Palo Verde)	Aug. 27, 2008	5,855	600	CSP/trough	Pending	Lower Sonoran
AZA 034946	Wildcat Harcuvar South, LLC	Jan. 28, 2009	10,947	800	CSP/tower	Pending	Lake Havasu

^a Total of 17 projects; solar acres = 230,900; total solar MW = 12,040.

^b To convert acres to km², multiply by 0.004047.



1
 2 **FIGURE 8.2.22.2-1 Locations of Renewable Energy Project ROW Applications within a 50-mi**
 3 **(80-km) Radius of the Proposed Bullard Wash SEZ**

TABLE 8.2.22.2-3 Other Major Actions near the Proposed Bullard Wash SEZ

Description	Status	Resources Affected	Primary Impact Location
Bagdad Mine	Operating since 1928	Groundwater, terrestrial habitat, wildlife, air quality, noise/vibration, cultural, visual	30 mi (48 km) north of the SEZ
Prescott Airport Solar Plant	Operating since 2005	Terrestrial habitat, visual	45 mi (72 km) northeast of the SEZ

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Bagdad Mine

Freeport-McMoRan Copper and Gold, Inc., operates a copper mine with molybdenum by-products near Bagdad, Arizona, about 30 mi (48 km) north of the SEZ. The ore is processed in a concentrated leach processing facility. The first mill began operation in 1928 to process ore from an underground mine. Open-pit mining began in 1945. Employment at the facility was 797 at the end of 2009 (Freeport-McMoRan 2010).

Prescott Airport Solar Plant

The Arizona Public Service (APS) operates a solar plant near the Prescott Arizona Airport, about 45 mi (72 km) northeast of the SEZ. The facility, constructed by Sharp Solar Electricity, is a 3.5-MW photovoltaic plant utilizing solar concentrators. The modules are on a single-axis tracking system (Sharp 2008).

Grazing Allotments

Three grazing allotments overlap Bullard Wash SEZ: the Pipeline, Forepaugh, and Carco allotments. Within 50 mi (80 km) of the SEZ, most of the land is covered with grazing allotments with the exception of the land to the northeast.

Mining

The BLM GeoCommunicator database (BLM and USFS 2010a) shows several active mining claims on file with BLM. The highest density (over 200 claims) is located about 10 mi (16 km) northwest of Bullard Wash SEZ. The Bagdad copper mine, located 30 mi (48 km) north of the SEZ, is described above.

1 **8.2.22.3 General Trends**

2
3
4 **8.2.22.3.1 Population Growth**

5
6 All three counties in the ROI experienced growth in population over the period 2000
7 to 2008. The population in La Paz County grew at an annual rate of 0.2%, and both Maricopa
8 and Yavapai Counties grew by 3.2%. The population of the ROI in 2008 was 4,193,198, having
9 grown at an average annual rate of 3.2% since 2000. The growth rate for the state of Arizona as
10 a whole was 3.0% (Section 8.2.19.1).

11
12
13 **8.2.22.3.2 Energy Demand**

14
15 The growth in energy demand is related to population growth through increases in
16 housing, commercial floorspace, transportation, manufacturing, and services. Given that
17 population growth is expected in La Paz, Maricopa and Yavapai Counties between 2006 and
18 2016, an increase in energy demand is also expected. However, the Energy Information
19 Administration (EIA) projects a decline in per-capita energy use through 2030, mainly because
20 of the high cost of oil and improvements in energy efficiency throughout the projection period.
21 Primary energy consumption in the United States between 2007 and 2030 is expected to grow by
22 about 0.5% each year; the fastest growth is projected for the commercial sector (at 1.1% each
23 year). Transportation, residential, and industrial energy consumption are expected to grow by
24 about 0.5, 0.4, and 0.1% each year, respectively (EIA 2009).

25
26
27 **8.2.22.3.3 Water Availability**

28
29 As described in Section 8.2.9.2, the ADWR has estimated that there are between
30 10 million and 23 million ac-ft (12 billion to 28 billion m³) of stored water available in the
31 entire Bill Williams basin and 8 million ac-ft (9.9 billion m³) in the region of the basin where
32 the Bullard Wash SEZ is located (the Date Creek basin). Groundwater recharge has been
33 estimated to be 32,000 ac-ft/yr (39.5 million m³/yr) within the entire Bill Williams basin, and
34 10,000 ac-ft/yr (12.3 million m³/yr) in the Date Creek basin, where the SEZ is located.

35
36 Data collected from 1974 to 2006 indicate that groundwater levels have fluctuated but
37 generally increased since the late 1980s in the Date Creek subbasin because of decreased
38 pumping in the basin (USGS 2010b).

39
40 In 2005, water withdrawals from surface waters and groundwater in Maricopa County
41 were 1,577,316 ac-ft/yr (1.9 billion m³/yr), 84% of which came from groundwater and 16%
42 from surface water. The largest water use category was irrigation (81%), at 1,271,515 ac-ft/yr
43 (1.56 billion m³/yr). Between 2001 and 2005, 5,650 ac-ft/yr (7 million m³/yr) of water was used
44 in the Bill Williams basin, of which 91% came from groundwater and 9% from surface water.
45 The primary use for groundwater in the basin is irrigation (80%), with smaller amounts used for

1 public supply (12%), and for industrial purposes (6%). Surface water from the Bill Williams
2 River is used primarily for municipal supply (ADWR 2010b).

3 4 5 **8.2.22.3.4 Climate Change** 6

7 A report on global climate change in the United States prepared by the U.S. Global
8 Change Research Program (GCRP 2009) documents current temperature and precipitation
9 conditions and historic trends. Excerpts of the conclusions from that report indicate the
10 following for the Southwest region of the United States, which includes Arizona:

- 11
- 12 • Decreased precipitation, with a greater percentage of that precipitation coming
13 from rain, will result in a greater likelihood of winter and spring flooding and
14 decreased stream flow in the summer.
- 15
- 16 • Increased frequency and altered timing of flooding have occurred. For
17 example, winter precipitation in Arizona is already becoming more variable,
18 with a trend toward both more frequent extremely dry and extremely wet
19 winters.
- 20
- 21 • The average temperature in the Southwest has already increased by about
22 1.5 F (0.8°C) compared to a 1960 to 1979 baseline, and by the end of the
23 century, the average annual temperature is projected to rise 4°F to 10°F
24 (2°C to 6°C).
- 25
- 26 • A warming climate and the related reduction in spring snowpack and soil
27 moisture have increased the length of the wildfire season and intensity of
28 forest fires.
- 29
- 30 • Later snow and less snow coverage in ski resort areas could force ski areas
31 to shut down before the season would otherwise end.
- 32
- 33 • Much of the Southwest has experienced drought conditions since 1999. This
34 represents the most severe drought in the last 110 years. Projections indicate
35 an increasing probability of drought in the region.
- 36
- 37 • As temperatures rise, the landscape will be altered as species shift their ranges
38 northward and upward to cooler climates.
- 39
- 40 • Temperature increases, when combined with urban heat island effects for
41 major cities such as Phoenix, present significant stress to health and electricity
42 and water supplies.
- 43
- 44 • Increased minimum temperatures and warmer springs extend the range and
45 lifetime of many pests that stress trees and crops, and lead to northward
46 migration of weed species.
- 47

1 **8.2.22.4 Cumulative Impacts on Resources**
2

3 This section addresses potential cumulative impacts in the vicinity of the proposed
4 Bullard Wash SEZ on the basis of the following assumptions: (1) because of the small size of the
5 proposed SEZ (<10,000 acres [$<40.5 \text{ km}^2$]), only one project would be constructed at a time, and
6 (2) maximum total disturbance over 20 years would be about 5,791 acres (23.4 km^2) (80% of the
7 entire proposed SEZ). For purposes of analysis, it is also assumed that no more than 3,000 acres
8 (12.1 km^2) would be disturbed per project annually and 250 acres (1.01 km^2) monthly on the
9 basis of construction schedules planned in current applications. It is also assumed that 152 acres
10 (0.62 km^2) would be disturbed to construct 5 mi (8 km) of new transmission line to reach an
11 existing 500-kV line to connect to the regional grid. Regarding site access, the nearest major
12 road is State Route 71, which is 5 mi (8 km) southeast of the SEZ. It is assumed that 5 mi (8 km)
13 of new access road, disturbing and additional 36 acres (0.15 km^2), would need to be constructed
14 from the SEZ to this road to support solar development in the SEZ.
15

16 Cumulative impacts that would result from the construction, operation, and
17 decommissioning of solar energy development projects within the proposed SEZ when added
18 to other past, present, and reasonably foreseeable future actions described in the previous
19 section are discussed below for each resource area. At this stage of development, because of
20 the uncertain nature of the future projects in terms of size, number, location within the
21 proposed SEZ, and the types of technology that would be employed, the impacts are discussed
22 qualitatively or semi-quantitatively, with ranges given as appropriate. More detailed analyses
23 of cumulative impacts would be performed in the environmental reviews for the specific projects
24 in relation to all other existing and proposed projects in the geographic areas.
25
26

27 **8.2.22.4.1 Lands and Realty**
28

29 The area covered by the proposed Bullard Wash SEZ is rural and undeveloped and is
30 used primarily for grazing and some recreation. An existing gravel road from U.S. 93 passes less
31 than 0.5 mi (0.8 km) north of the SEZ. There are no existing ROWs within the proposed SEZ
32 and no ROW applications for solar facilities as of February 2010 (Section 8.2.2.1).
33

34 Development of the SEZ for utility-scale solar energy production would establish an
35 isolated, industrial area that would exclude many existing and potential uses of the land, perhaps
36 in perpetuity. Since the SEZ is rural and undeveloped, utility-scale solar energy development
37 would be a new and dominant land use in the area. Access to such areas by both the general
38 public and much wildlife would be eliminated.
39

40 As shown in Table 8.2.22.2-1, there are no fast-track solar applications or other firmly
41 foreseeable renewable energy or energy distribution projects within a 50-mi (80-km) radius of
42 the proposed Bullard Wash SEZ. However, as shown in Table 8.2.22.2-2 and Figure 8.2.22.2-1,
43 there 17 pending solar applications, but no wind or geothermal applications, on public land
44 within this distance. The large number of pending solar energy applications indicates strong
45 interest in solar energy development in the region south of the SEZ. The proposed Brenda SEZ
46 is located about 45 mi (72 km) southwest.
47

1 Other major ongoing actions within 50 mi (80 km) of the proposed SEZ
2 (Section 8.2.22.2.2), mainly the Bagdad copper mine, would have minimal impacts
3 on land use on or near the SEZ, as they are few in number and far away.
4

5 The development of utility-scale solar projects in the proposed Bullard Wash SEZ
6 in combination with other ongoing, foreseeable and potential actions within the geographic
7 extent of effects, nominally 50 mi (80 km), could have small cumulative effects on land use
8 in the vicinity of the proposed SEZ through impacts on land access and use for other purposes,
9 groundwater availability, and on visual resources, especially if the SEZ is fully developed
10 with solar projects. Cumulative impacts would depend mainly on the number of pending solar
11 applications in the region that result in actual developments. However, projects within the SEZ
12 would make only a small contribution to cumulative impacts due to its relatively small size.
13
14

15 ***8.2.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics*** 16

17 Thirteen specially designated areas are located within 25 mi (40 km) of the proposed
18 Bullard Wash SEZ that potentially could be affected by solar energy development within the
19 SEZ. All but one of these areas is more than 5 mi (8 km) from the SEZ (Section 8.2.3.1).
20 Potential exists for cumulative visual impacts on these areas from the construction of utility-scale
21 solar energy facilities within the SEZ and outside the SEZ within the geographic extent of effects
22 and from the construction of transmission lines and roads outside the SEZ. The exact nature of
23 cumulative visual impacts on the users of these areas would depend on the specific solar
24 technologies employed and the locations of solar facilities, transmission lines, and roads
25 actually built within and outside the SEZ. About five pending solar applications lie within
26 25 mi (40 km) of the proposed SEZ, all to the south (Figure 8.2.22.2-1). Some of these projects,
27 if built, could affect some of the same sensitive areas as facilities built within the SEZ. Such
28 effects could include visual impacts, impacts on wilderness values, reduced accessibility, and
29 ecological effects.
30
31

32 ***8.2.22.4.3 Rangeland Resources*** 33

34 The proposed Bullard Wash SEZ contains small portions of three perennial grazing
35 allotments (Section 8.2.4.1.1). If utility-scale solar facilities are constructed on the SEZ, those
36 areas occupied by the solar projects would be excluded from grazing. The development of other
37 potential solar energy projects within 50 mi (80 km) of the SEZ could result in cumulative
38 impacts on grazing due to the number and relative proximity of several of the potential projects
39 to the proposed SEZ. However, the contribution of such effects from projects within the SEZ
40 would be minimal due to the small area affected.
41

42 Portions of four BLM HMAs and HAs occur within the 50 mi (80 km) of the proposed
43 Bullard Wash SEZ (Section 8.2.4.2.1), but none occurs in the proposed SEZ or within the 5-mi
44 (8-km) area of indirect effects. Thus, solar developments in the SEZ would not contribute to
45 cumulative effects on wild horses and burros.
46
47

1 **8.2.22.4.4 Recreation**
2

3 Low levels of backcountry driving, OHV use, hunting, photography, and rockhounding
4 are the most likely recreational uses of the area of the proposed SEZ (Section 8.2.5.1). While
5 there are no current solar applications within the proposed SEZ, construction of utility-scale solar
6 projects on the SEZ would preclude recreational use of the affected lands for the duration of the
7 projects. Road closures and access restrictions within any developed portions of the proposed
8 SEZ would affect OHV use in particular if inventoried routes are affected. However, such effects
9 are expected to be small due to low current use. Potential future actions, mainly pending solar
10 applications, would also affect areas of low recreational use and would have similar minimal
11 effects on current recreational activities individually. However, small cumulative impacts on
12 recreation within the geographic extent of effects might be possible from the aggregate presence
13 of several new solar facilities within the area if a large number of projects with pending
14 applications are ultimately built.
15

16 **8.2.22.4.5 Military and Civilian Aviation**
17

18 The entire SEZ is covered by two MTRs with 300-ft (91-m) above-ground-level
19 operating limits, and the SEZ is located 57 mi (92 km) northwest of Luke Air Force Base
20 (Section 8.2.6.1). The military has indicated that construction of solar or transmission facilities
21 in excess of 250 ft (76 m) tall could adversely affect both MTRs (Section 8.2.6.2). Potential new
22 solar facilities and associated new transmission lines outside the SEZ could present additional
23 potential concerns for military aviation, depending on the eventual location of such facilities
24 with respect to training routes, and thus, could result in cumulative impacts on military aviation.
25
26

27 The closest civilian airport, Wickenburg Municipal Airport is 25 mi (40 km) southeast
28 and thus is too far away to be affected by developments in the SEZ.
29
30

31 **8.2.22.4.6 Soil Resources**
32

33 Ground-disturbing activities (e.g., grading, excavating, and drilling) during the
34 construction phase of a solar project, including the construction of any associated transmission
35 line connections and new roads, would contribute to soil loss due to wind erosion. Road use
36 during construction, operations, and decommissioning of the solar facilities would further
37 contribute to soil loss. Programmatic design features would be employed to minimize erosion
38 and loss. Residual soil losses with these mitigation measures in place would be in addition to
39 losses from construction of other potential solar energy facilities and other ongoing activities,
40 including OHV use. Cumulative impacts on soil resources from other foreseeable projects within
41 the geographic extent of effects are possible. Potential new solar facilities outside the SEZ would
42 contribute incremental impacts on soil erosion, the extent of which would depend on the number
43 and location of facilities actually built. Cumulative impacts, including from any development in
44 the SEZ, would be small with required design features in place.
45

1 Landscaping of solar energy facility areas in the SEZ could alter drainage patterns and
2 lead to increased siltation of surface water streambeds, in addition to that from other potential
3 solar developments and other activities outside the SEZ. However, with the required design
4 features in place, cumulative impacts likewise would be small.
5
6

7 **8.2.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)**

8

9 As discussed in Section 8.2.8, there are currently no active oil and gas leases within
10 the proposed Bullard Wash SEZ, and no mining claims or proposals for geothermal energy
11 development are pending. Because of the generally low level of mineral production in the
12 proposed SEZ and surrounding area and the expected low impact on mineral accessibility of
13 other foreseeable actions within the geographic extent of effects, no cumulative impacts on
14 mineral resources are expected.
15
16

17 **8.2.22.4.8 Water Resources**

18

19 Section 8.2.9.2 describes the water requirements for various solar technologies if they
20 were to be employed on the proposed SEZ to develop utility-scale solar energy facilities. The
21 amount of water needed during the peak construction year for all evaluated solar technologies
22 would be 1,228 to 1,816 ac-ft (1.5 million to 2.2 million m³). During operations, with full
23 development of the SEZ over 80% of its available land area, the amount of water needed
24 for all evaluated solar technologies would range from 33 to 17,390 ac-ft/yr (41,000 to
25 21 million m³/yr). The amount of water needed during decommissioning would be similar
26 to or less than the amount used during construction.
27

28 As discussed in Section 8.2.22.3.3, water withdrawals in 2005 in Maricopa County were
29 1.6 million ac-ft/yr (1.9 billion m³/yr), 84% of which came from groundwater and 16% from
30 surface water. The largest water use category was irrigation at 81%. Therefore, cumulatively
31 the additional water resources needed for solar facilities in the SEZ during operations would
32 constitute from a relatively very small (0.002%) to a small (1.1%) increment in the county (the
33 ratio of the annual operations water requirement to the annual amount withdrawn in Maricopa
34 County), depending on the solar technology used (PV technology at the low end and the wet-
35 cooled parabolic trough technology at the high end). More locally, between 2001 and 2005,
36 water use in the Bill Williams basin was 5,650 ac-ft/yr (7 million m³/yr); of which 91% came
37 from groundwater and 9% from surface water (Section 8.2.9.1.3). Current groundwater use is
38 below estimates of natural recharge of 32,000 ac-ft/yr (39 million m³/yr) for the entire Bill
39 Williams basin. For the portion of the basin that contains the proposed Bullard Wash SEZ (the
40 Date Creek basin), the estimated recharge rate is 10,000 ac-ft/yr (12 million m³/yr). Thus, solar
41 developments on the SEZ alone would have the capacity to exceed local basin recharge using
42 wet-cooling, while full development with dry-cooled solar trough technologies could require
43 18% of estimated annual recharge beneath the SEZ (Section 8.2.9.2.2).
44

45 Solar development of the proposed SEZ with water-intensive technologies might be
46 judged infeasible because of concerns regarding groundwater supplies. Intensive groundwater

1 withdrawals could lower the water table, decrease the volume of stored water, change the
2 direction of groundwater flow, and produce land subsidence (Section 8.2.9.2). Cumulative
3 impacts on groundwater could occur when combined with other future developments in the
4 region. It would be expected that some number of the 17 pending solar applications within 50 mi
5 (80 km) of the proposed SEZ (Section 8.2.22.2.1) will ultimately be built, and that some of these
6 projects could contribute to cumulative effects on groundwater supplies in the Bill Williams
7 basin, as well as on surface ecological habitats from soil erosion, sedimentation, and drainage
8 effects from such large facilities.

9
10 Small quantities of sanitary wastewater would be generated during the construction
11 and operation of the potential utility-scale solar energy facilities. The amount generated from
12 solar facilities would be in the range of 9 to 74 ac-ft (11,000 to 91,000 m³) during the peak
13 construction year and would range from 0.7 to 16 ac-ft/yr (up to 20,000 m³/yr) during
14 operations. Because of the small quantity, the sanitary wastewater generated by the solar energy
15 facilities would not be expected to put undue strain on available sanitary wastewater treatment
16 facilities in the general area of the SEZ. For technologies that rely on conventional wet-cooling
17 systems, there would also be from 183 to 329 ac-ft/yr (226,000 to 406,000 m³/yr) of blowdown
18 water from cooling towers. Blowdown water would need either to be treated on-site or sent to an
19 off-site facility. Any on-site treatment of wastewater would have to ensure that treatment ponds
20 are effectively lined in order to prevent any groundwater contamination. Thus, blowdown water
21 would not contribute to cumulative effects on treatment systems or on groundwater.

22 23 24 **8.2.22.4.9 Vegetation**

25
26 The proposed Bullard Wash SEZ is located within the Sonoran Basin and Range
27 ecoregion, which supports creosotebush-bur sage plant communities with large areas of palo
28 verde-cactus shrub and saguaro cactus communities. Lands within the SEZ are classified
29 primarily as Sonora–Mojave Creosotebush–White Bursage Desert Scrub. Sensitive habitats on
30 the SEZ include desert dry washes, dry wash woodlands, and desert riparian mesquite bosque,
31 which is dependent on accessible groundwater. Three small mapped wetlands occur in the SEZ.
32 In the 5-mi (8-km) area of indirect effects, the predominant cover types are Sonora–Mojave
33 Creosotebush–White Bursage Desert Scrub and Sonoran Paloverde-Mixed Cacti Desert Scrub.
34 Thirty-five wetlands are mapped in the indirect impact area (Section 8.2.10.1). If utility-scale
35 solar energy projects were to be constructed within the SEZ, all vegetation within the footprints
36 of the facilities would likely be removed during land-clearing and land-grading operations. Full
37 development of the SEZ over 80% of its area would result in small impacts on all cover types
38 (Section 8.2.10.2.1). Intermittently flooded areas downgradient from solar projects or access
39 road could be affected by ground-disturbing activities. Alteration of surface drainage patterns
40 or hydrology could adversely affect downstream dry wash communities, including dry-wash
41 woodlands habitat. In addition, mesquite bosque communities that depend on accessible
42 groundwater could be impacted by lowered groundwater levels if solar projects were to draw
43 heavily on this resource.

44
45 The fugitive dust generated during construction of solar facilities could increase the dust
46 loading in habitats outside a solar project area, in combination with that from other construction,

1 mining, agriculture, recreation, and transportation. The cumulative dust loading could result in
2 reduced productivity or changes in plant community composition. Similarly, surface runoff from
3 project areas after heavy rains could increase sedimentation and siltation in areas downstream.
4 Implementation of programmatic design features would reduce the impacts from solar energy
5 projects and thus the overall cumulative impacts on plant communities and habitats.
6

7 While most of the cover types within the SEZ affected area are relatively common in
8 the region, a number of species present represent less than 1% of land area within the region,
9 including: North American Warm Desert Riparian Mesquite Bosque (0.09%), Barren Lands,
10 Non-specific (0.1%), and North American Warm Desert Riparian Woodland and Shrubland
11 (0.1%) (Section 8.2.10.2.1). Thus, other ongoing and reasonably foreseeable future actions
12 could have a cumulative effect on these and other rare cover types, as well as on more abundant
13 species. Such effects would likely be small for foreseeable development due to the abundance
14 of the primary species and the absence of major foreseeable actions within the 50-mi (80-km)
15 geographic extent of effects. However, given the large number of pending solar applications
16 within this area and the large acreages potentially disturbed (Section 8.2.22.2.1), depending on
17 where any eventual projects are located, cumulative effects on some rare cover types are
18 possible. In addition, cumulative effects on wetland species could occur from water use, drainage
19 modifications, and stream sedimentation from these and any other potential future developments
20 in the region. The magnitude of such effects is difficult to predict at this time.
21
22

23 **8.2.22.4.10 Wildlife and Aquatic Biota**

24

25 Wildlife species that could potentially be affected by the development of utility-scale
26 solar energy facilities in the proposed Bullard Wash SEZ include amphibians, reptiles, birds, and
27 mammals. The construction of utility-scale solar energy projects in the SEZ and any associated
28 transmission lines and roads in or near the SEZ would have an impact on wildlife through habitat
29 disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, loss of
30 connectivity between natural areas, and wildlife injury or mortality. In general, species with
31 broad distributions and a variety of habitats would be less affected than species with a narrowly
32 defined habitat within a restricted area. The required design features would reduce the severity of
33 impacts on wildlife. The design features include pre-disturbance biological surveys to identify
34 key habitat areas used by wildlife, followed by avoidance or minimization of disturbance to
35 those habitats.
36

37 As noted in Section 8.2.22.2, while no major foreseeable actions have been identified
38 within 50 mi (80 km) of the proposed SEZ, 17 pending solar applications are within this distance
39 (Figure 8.2.22.2-1). Impacts from full build-out over 80% of the proposed SEZ would result in
40 small impacts on wildlife species (Section 8.2.11), while impacts from potential development
41 within the 50-mi (80-km) geographic extent of effects would depend on the number of facilities
42 actually built. Many of the wildlife species present within the proposed SEZ that could be
43 affected by other actions have extensive available habitat within the region, while no foreseeable
44 solar or other major projects have been identified within the geographic extent of effects.
45 However, cumulative effects could accrue on some species from some number of the 17 pending
46 solar applications in the region given the large acreages potentially disturbed.
47

1 No surface waterbodies or perennial streams are within the proposed Bullard Wash SEZ
2 or within the 5-mi (8-km) area of indirect effects. Several ephemeral streams, including Bullard
3 Wash, and a number of small mapped wetlands are within the SEZ and in the area of indirect
4 effects. However, these areas are expected to be dry except after rainfall and are not expected to
5 support aquatic habitat, with the possible exception of Date Creek, an intermittent stream located
6 north of the SEZ in the area of indirect effects (Section 8.2.11.4.1). Thus, no standing aquatic
7 communities are likely to be present in the proposed SEZ. Aquatic communities do exist within
8 the 50-mi (80-km) geographic extent of effects, including in Alamo Lake, about 18 mi (39 km)
9 northwest of the SEZ (Section 8.2.11.2). However, these habitats are too far away to be affected
10 by solar developments in the SEZ assuming required design features are implemented, and there
11 no pending solar applications north of the proposed SEZ in the direction of these habitats. Thus,
12 there would be no cumulative impacts on aquatic biota and habitats resulting from groundwater
13 drawdown or soil transport to surface streams from solar facilities within the geographic extent
14 of effects.

15 16 17 **8.2.22.4.11 Special Status Species (Threatened, Endangered, Sensitive, 18 and Rare Species)** 19

20 On the basis of recorded occurrences or presence of suitable habitat, as many as
21 39 special status species could occur within the Bullard Wash SEZ. Eight of these species are
22 known or are likely to occur within the affected area of the SEZ (including the SEZ, the 5-mi
23 [8-km] area of indirect effects, and road and transmission ROWs): desert pupfish, Gila
24 topminnow, lowland leopard frog, Sonoran desert tortoise, Gila monster, Mojave shovel-nosed
25 snake, California leaf-nosed bat, and cave myotis. Section 8.2.12.1 discusses the nature of the
26 special status listing of these eight species. Numerous additional species that may occur on or in
27 the vicinity of the SEZ are listed as threatened or endangered by the State of Arizona or are listed
28 as a sensitive species by the BLM (Section 8.2.12.1). Design features to be used to reduce or
29 eliminate the potential for effects on these species from the construction and operation of utility-
30 scale solar energy projects in the SEZs and related developments (e.g., access roads and
31 transmission line connections) outside the SEZ include avoidance of habitat and minimization of
32 erosion, sedimentation, and dust deposition. Ongoing effects on special status species include
33 those from roads, transmission lines, and recreational activities in the area. While no major
34 foreseeable developments have been identified within the 50-mi (80-km) geographic extent of
35 effects, 17 pending applications for solar projects lie within that area and cover areas much larger
36 than the proposed SEZ. Cumulative impacts on protected species are expected to be relatively
37 low, but could rise if a large number of the pending solar applications are actually built, as
38 applications tend to lie in areas with topography and habitat similar to that in the SEZ. Actual
39 impacts would further depend on the location, and cooling technologies of projects that are built.
40 Projects would employ mitigation measures to limit effects.

41 42 43 **8.2.22.4.12 Air Quality and Climate** 44

45 While solar energy generates minimal emissions compared with fossil fuels, the site
46 preparation and construction activities associated with solar energy facilities would be

1 responsible for some amount of air pollutants. Most of the emissions would be particulate
2 matter (fugitive dust) and emissions from vehicles and construction equipment. When these
3 emissions are combined with those from other nearby projects outside the proposed Bullard
4 Wash SEZ or when they are added to natural dust generation from winds and windstorms, the air
5 quality in the general vicinity of the projects could be temporarily degraded. For example, the
6 maximum 24-hour PM₁₀ concentration at or near the SEZ boundaries could at times exceed the
7 applicable standard of 150 µg/m³. Dust generation by construction activities can be controlled by
8 implementing aggressive dust control measures, such as increased watering frequency or road
9 paving or treatment.

10
11 Because the area proposed for the SEZ is rural and undeveloped land, there are no
12 significant industrial sources of air emissions in the area. The only type of air pollutant of
13 concern is dust generated by winds. While there are a number of potential solar projects that
14 could produce fugitive dust emissions within the geographic extent of effects, few such projects
15 are likely to overlap in both time and affected area with any projects within the SEZ. Thus,
16 cumulative air quality effects due to dust emissions during any overlapping construction periods
17 would be small.

18
19 Over the long term and across the region, the development of solar energy may have
20 beneficial cumulative impacts on the air quality and atmospheric values by offsetting the need
21 for energy production that results in higher levels of emissions, such as by use of coal, oil, and
22 natural gas. As discussed in Section 8.2.13.2.2, air emissions from operating solar energy
23 facilities are relatively minor, while the displacement of criteria air pollutants, VOCs, TAPs, and
24 GHG emissions currently produced from fossil fuels could be significant. For small SEZs, such
25 offsets are fairly modest. For example, if the Bullard Wash SEZ was fully developed (80% of its
26 acreage) with solar facilities, the quantity of pollutants avoided could be up to 2.9% of all
27 emissions from the current electric power systems in Arizona.

30 **8.2.22.4.13 Visual Resources**

31
32 The proposed Bullard Wash SEZ lies within the flat plain of a valley floor bounded by
33 mountain ranges to the north and southwest, with open views to the east and northwest and is
34 fairly well vegetated (Section 8.2.14.1). The area is sparsely inhabited, remote, and rural in
35 character. Existing cultural modifications detract very slightly from the scenic quality of the
36 SEZ. Construction of utility-scale solar facilities on the SEZ and associated transmission lines
37 outside the SEZ would significantly alter the natural scenic quality of the area. Other potential
38 solar projects and related roads and transmission lines outside the proposed SEZ would
39 cumulatively affect the visual resources in the area.

40
41 There are currently no identified major foreseeable actions in the area, but there are
42 17 pending solar applications within 50 mi (80 km) of the SEZ (Figure 8.2.22.2-1). While the
43 contribution to cumulative impacts in the area of potential projects would depend on the
44 locations of facilities that are actually built, it may be concluded that the general visual character
45 of the landscape within the region could be significantly altered by the presence of solar
46 facilities, transmission lines, and other new infrastructure. Because of the topography of the

1 region, such developments, located in basin flats, would be visible at great distances from
2 surrounding mountains, which include sensitive viewsheds. Given the proximity of several of the
3 pending solar applications to the proposed SEZ and to each other, it is possible that two or more
4 facilities would be viewable from a single location. In addition, facilities would be located near
5 major roads and thus would be viewable by motorists, who would also be viewing transmission
6 lines, towns, and other infrastructure, as well as the road system itself.
7

8 As additional facilities are added, several projects might become visible from one
9 location, or in succession, as viewers move through the landscape, such as by driving on
10 local roads. In general, the new developments would be expected to vary in appearance and,
11 depending on the number and type of facilities, the resulting visual disharmony could exceed
12 the visual absorption capability of the landscape and add significantly to the cumulative visual
13 impact. Considering the above and the large number of pending solar applications in the region,
14 moderate cumulative visual impacts could occur within the geographic extent of effects from
15 future solar and other existing and future developments.
16
17

18 ***8.2.22.4.14 Acoustic Environment***

19
20 The areas around the proposed Bullard Wash SEZ are relatively quiet. The existing
21 noise sources include road traffic, railroad traffic, private/commercial/military aircraft flyover,
22 and cattle grazing. The construction of solar energy facilities could increase the noise levels
23 periodically for up to 3 years per facility, but there would be little or no noise during operation of
24 solar facilities, except from solar dish engine facilities and from parabolic trough or power tower
25 facilities using TES.
26

27 Other ongoing and reasonably foreseeable and potential future activities in the general
28 vicinity of the SEZs are described in Section 8.2.22.2. Because proposed projects and nearest
29 residents are relatively far from the SEZ with respect to noise impacts, and because the area is
30 sparsely populated, cumulative noise effects during the construction or operation of solar
31 facilities are unlikely.
32
33

34 ***8.2.22.4.15 Paleontological Resources***

35
36 The proposed Bullard Wash SEZ has unknown potential for the occurrence of significant
37 fossil material over its entire extent and would require further investigation prior to project
38 approval (Section 8.2.16.1). Any paleontological resources encountered during a paleontological
39 survey would be mitigated to the extent possible. Cumulative impacts on paleontological
40 resources would be dependent on whether significant resources are found within the SEZ and in
41 additional project areas in the region.
42
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44

1 **8.2.22.4.16 Cultural Resources**
2

3 No surveys have been conducted within the boundaries of the proposed Bullard Wash
4 SEZ, but some sites have been recorded within 5 mi (8 km) of the SEZ (Section 8.2.17.1.5).
5 The proposed SEZ has potential for containing both prehistoric sites and historic sites
6 (Section 8.2.17.2). It is possible, but unlikely, that the development of utility-scale solar energy
7 projects in the SEZ, when added to other potential projects likely to occur in the area, could
8 contribute cumulatively to cultural resource impacts occurring in the region. The amount of
9 foreseeable development is low within the 25-mi (40-km) geographic extent of effects; however,
10 several potential solar developments with pending applications lie within this distance
11 (Section 8.2.22.2). While any future solar projects would disturb large areas, the specific sites
12 selected for future projects would be surveyed; historic properties encountered would be avoided
13 or mitigated to the extent possible. Through ongoing consultation with the Arizona SHPO and
14 appropriate Native American governments, it is likely that most adverse effects on significant
15 resources in the region could be mitigated to some degree. While avoidance of all NRHP-eligible
16 sites and mitigation of all impacts may not be possible, it is unlikely that any sites recorded in the
17 SEZ would be of such individual significance that development would cumulatively cause an
18 irretrievable loss of information about a significant resource type, but this would depend on the
19 results of the future surveys and evaluations.
20

21 **8.2.22.4.17 Native American Concerns**
22

23 Government-to-government consultation is underway with federally recognized Native
24 American Tribes, including several Yavapai tribes, with possible traditional ties to the Bullard
25 Wash area. All such Tribes have been contacted and provided an opportunity to comment or
26 consult regarding this PEIS. To date, no specific concerns have been raised to the BLM
27 regarding the proposed Bullard Wash SEZ. However, the Quechan Indian Tribe of Fort Yuma
28 has expressed concerns for landscapes as a whole, and specifically with respect to the intrusion
29 of industrial development on cultural landscapes and traditional trails. In addition, impacts on
30 game and wild plant resources have been a concern of the Yavapai in the past. Potential impacts
31 on existing water supplies, ecological fragmentation, and land disturbance are also of concern to
32 tribes (Section 8.2.18). The development of solar energy facilities in combination with the
33 development of other planned and foreseeable projects in the area would likely reduce the
34 traditionally important plant and animal resources available to the Tribes. Such effects would
35 likely be small for foreseeable development due to the abundance of the most culturally
36 important plant species and the relatively small number of foreseeable actions within the
37 geographic extent of effects. Continued discussions with the area Tribes through government-
38 to-government consultation is necessary to effectively consider and address the Tribes' concern
39 tied to solar energy development in the Bullard Wash SEZ.
40

41 **8.2.22.4.18 Socioeconomics**
42

43 Solar energy development projects in the proposed Bullard Wash SEZ could
44 cumulatively contribute to socioeconomic effects in the immediate vicinity of the SEZs and
45
46

1 in the surrounding multicounty ROI. The effects could be positive (e.g., creation of jobs and
2 generation of extra income, increased revenues to local governmental organizations through
3 additional taxes paid by the developers and workers) or negative (e.g., added strain on social
4 institutions such as schools, police protection, and health care facilities). Impacts from solar
5 development would be most intense during facility construction, but of greatest duration
6 during operations. Construction would temporarily increase the number of workers in the area
7 needing housing and services in combination with temporary workers involved in other new
8 developments in the area, including other renewable energy developments. The number of
9 workers involved in the construction of solar projects in the peak construction year (including
10 the transmission lines) could range from about 130 to 1,700, depending on the technology being
11 employed (with solar PV facilities at the low end and solar trough facilities at the high end).
12 The total number of jobs created in the area could range from about 480 (solar PV) to as high
13 as 5,500 (solar trough). Cumulative socioeconomic effects in the ROI from construction of solar
14 facilities would occur to the extent that multiple construction projects of any type were ongoing
15 at the same time. It is a reasonable expectation that this condition occasionally would occur
16 within a 50-mi (80-km) radius of the SEZ over the 20-year or more solar development period.
17

18 Annual impacts during the operation of solar facilities would be less, but of 20- to
19 30-year duration, and could combine with those from other new developments in the area,
20 including from some number of the 17 pending solar applications within 50 mi (80 km) of the
21 proposed SEZ. The number of workers needed at the solar facilities in the SEZ would be in the
22 range of 13 to 250, with about 18 to 410 total jobs created in the region, assuming full build-out
23 of the SEZ (Section 8.2.19.2.2). Population increases would contribute to general upward growth
24 trends in the region in recent years. The socioeconomic impacts overall would be positive,
25 through the creation of additional jobs and income. The negative impacts, including some short-
26 term disruption of rural community quality of life, would not likely be considered large enough
27 to require specific mitigation measures.
28
29

30 **8.2.22.4.19 Environmental Justice**

31
32 Any impacts from solar development could have cumulative impacts on minority and
33 low-income populations within 50 mi (80 km) of the proposed SEZ in combination with other
34 development in the area. Such impacts could be both positive, such as from increased economic
35 activity, and negative, such as from visual impacts, noise, and exposure to fugitive dust
36 (Section 8.2.20.2). Actual impacts would depend on where low-income populations are located
37 relative to solar and other proposed facilities and on the geographic range of effects. Overall,
38 effects from facilities within the SEZ are expected to be small, while other foreseeable and
39 potential actions would not likely combine with negative effects from the SEZ on minority or
40 low-income populations, with the possible exception of visual impacts from solar development
41 in the region. Thus, it is not expected that the proposed Bullard Wash SEZ would contribute to
42 cumulative impacts on minority and low-income populations.
43
44
45

1 **8.2.22.4.20 Transportation**
2

3 State Route 71 is 5 mi (8 km) southeast and U.S. 93 is 5.5 mi (9 km) northeast of the
4 proposed Bullard Wash SEZ. The nearest public airport is the Wickenburg Municipal Airport,
5 22 mi (35 km) southeast of the SEZ. The closest rail stop is in Congress, about 16 mi (26 km)
6 east of the SEZ. During construction of utility-scale solar energy facilities, there could be up to
7 1,000 workers commuting to the construction site at the SEZ, which could increase the AADT
8 on these roads by 2,000 vehicle trips for each facility under construction. Traffic on State
9 Route 71 could more than triple, while U.S. 93 could experience minor slowdowns near the SEZ
10 (Section 8.2.21.2). This increase in highway traffic from construction workers could likewise
11 have small cumulative impacts in combination with existing traffic levels and increases from
12 additional future developments in the area, including from construction of potential solar
13 facilities in the region with pending applications, should construction schedules overlap. Local
14 road improvements may be necessary on portions of U.S. 93 near the existing gravel road access.
15 Any impacts during construction activities would be temporary. The impacts could also be
16 mitigated to some degree by staggered work schedules and ride-sharing programs. Traffic
17 increases during operation would be relatively small because of the low number of workers
18 needed to operate the solar facilities and would have little contribution to cumulative impacts.
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8.2.23 References

Note to Reader: This list of references identifies Web pages and associated URLs where reference data were obtained for the analyses presented in this PEIS. It is likely that at the time of publication of this PEIS, some of these Web pages may no longer be available or their URL addresses may have changed. The original information has been retained and is available through the Public Information Docket for this PEIS.

ADEQ (Arizona Department of Environmental Quality), 2009, *2009 Air Quality Annual Report*. Available at http://www.azdeq.gov/function/forms/download/2009_Annual_Report-AQD.pdf. Accessed July 24, 2010.

ADEQ, 2010, *Water Quality: Permits: Stormwater*. Available at <http://www.azdeq.gov/environ/water/permits/stormwater.html>. Accessed July 12, 2010.

ADOT (Arizona Department of Transportation), 2010a, *State Highway Traffic Log*, March. Available at <http://www.azdot.gov/mpd/data/Reports/PDF/SHSTrafficLog2006-2008ver2-Rounded.pdf>. Accessed Aug. 5, 2010.

ADOT, 2010b, *Average Annual Daily Traffic (AADT) AADT Reports (Traffic Counts), Current AADTs, 2006 to 2008*, Multimodal Planning Division. Available at <http://mpd.azdot.gov/mpd/data/aadt.asp>. Accessed July 16, 2010.

ADWR (Arizona Department of Water Resources), 1999, *Section III: Future Conditions and Directions*, Third Management Plan for Phoenix Active Management Area 2000–2010, December 1999.

ADWR, 2010a, *Arizona Water Atlas*. Available at <http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/default.htm>. Accessed July 8, 2010.

ADWR, 2010b, *Bill Williams Basin*. Available at http://www.azwater.gov/azdwr/StatewidePlanning/RuralPrograms/OutsideAMAs_PDFs_for_web/Upper_Colorado_River_Planning_Area/Bill_Williams_Basin.pdf. Accessed June 15, 2010.

ADWR, 2010c, *Overview of the Arizona Groundwater Management Code*. Available at http://www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf. Accessed Jun 21, 2010.

ADWR, 2010d, *A Practical Guide to Drilling a Well in Arizona*. Available at <http://www.azwater.gov/AzDWR/WaterManagement/Wells/documents/wellguide.pdf>. Accessed July 12, 2010.

ADWR, 2010e, *Water Management Requirements for Solar Power Plants in Arizona*. Available at http://www.azwater.gov/azdwr/WaterManagement/solar/documents/Solar_Regulation_Summary_FINAL.pdf. Accessed June 21, 2010.

1 ADWR, 2010f, *About ADWR*, Available at [http://www.adwr.state.az.us/azdwr/](http://www.adwr.state.az.us/azdwr/PublicInformationOfficer/About_ADWR.htm)
2 [PublicInformationOfficer/About_ADWR.htm](http://www.adwr.state.az.us/azdwr/PublicInformationOfficer/About_ADWR.htm). Accessed June 21, 2010.
3
4 ADWR, 2010g, *Active Management Areas (AMAs) & Irrigation Non-expansion Areas (INAs)*.
5 Available at <http://www.azwater.gov/AzDWR/WaterManagement/AMAs/>. Accessed June 22,
6 2010.
7
8 ADWR, 2010h, *Colorado River Management*. Available at [http://www.azwater.gov/AzDWR/](http://www.azwater.gov/AzDWR/StateWidePlanning/CRM/Overview.htm)
9 [StateWidePlanning/CRM/Overview.htm](http://www.azwater.gov/AzDWR/StateWidePlanning/CRM/Overview.htm). Accessed July 21, 2010.
10
11 ADWR, 2010i, *Overview of the Arizona Groundwater Management Code*. Available at
12 http://www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf.
13 Accessed June 21, 2010.
14
15 AECOM (Architectural Engineering, Consulting, Operations and Maintenance), 2009, *Project*
16 *Design Refinements*. Available at [http://energy.ca.gov/sitingcases/beacon/documents/applicant/](http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf)
17 [refinements/002_WEST1011185v2_Project_Design_Refinements.pdf](http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf). Accessed Sept. 2009.
18
19 AGS (Arizona Geological Survey), 2010, *Locations of Mapped Earth Fissure Traces in Arizona,*
20 *Digital Information 39 (DI-39), Version 6.22.09*. Available at [http://www.azgs.az.gov/](http://www.azgs.az.gov/efresources.shtml)
21 [efresources.shtml](http://www.azgs.az.gov/efresources.shtml). Accessed July 22, 2010.
22
23 AMA (American Medical Association), 2009, *Physician Characteristics and Distribution in the*
24 *U.S.*, Chicago, Ill. Available at <http://www.ama-assn.org/ama/pub/category/2676.html>.
25
26 Anderson, T.W., 1995, *Summary of the Southwest Alluvial Basins, Regional Aquifer-system*
27 *Analysis, South-central Arizona and Parts of Adjacent States*, U.S. Geological Survey
28 Professional Paper 1406-A.
29
30 Anduze, R.A., et al., 2003, *Prehistory in West Prescott, Arizona*, SWCA Anthropological
31 Research Paper Number 9.
32
33 ANHP (Arizona National Heritage Program), 2010, *Arizona's Natural Heritage Program:*
34 *Heritage Data Management System (HDMS)*. Available at [http://www.azgfd.gov/w_c/](http://www.azgfd.gov/w_c/edits/species_concern.shtml)
35 [edits/species_concern.shtml](http://www.azgfd.gov/w_c/edits/species_concern.shtml). Accessed July 20, 2010.
36
37 Arizona Department of Commerce, 2010, *Arizona Population Projections*. Available at
38 <http://www.azcommerce.com/EconInfo/Demographics/Population+Projections.htm>.
39
40 Arizona Field Ornithologists, 2010, *Field Checklist of the Birds of La Paz County*. Available at
41 <http://azfo.org/documents/LaPaz.pdf>. Accessed July 25, 2010.
42
43 AZDA (Arizona Department of Agriculture), 2010, *Prohibited, Regulated, and Restricted*
44 *Noxious Weeds*, Plant Services Division.
45

1 AZSITE, 2009, *AZSITE: Arizona's Cultural Resource Inventory*, data search run by Arizona
2 State Museum, Dec. 11, 2009.
3

4 AZSITE, 2010, *AZSITE: Arizona's Cultural Resource Inventory*, data search run by Arizona
5 State Museum, July 15, 2010.
6

7 Bailie, A. et al., 2005, *Final Arizona Greenhouse Gas Inventory and Reference Case Projections*
8 *1990–2020*, Arizona Department of Environmental Quality (ADEQ) and Center for Climate
9 Strategies (CCS), June. Available at [http://azmemory.lib.az.us/cdm4/item_viewer.php?](http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4)
10 [CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4](http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4). Accessed July 20, 2010.
11

12 Baker, L., and Bickaaskas, T., 2010, personal communication from Baker and Bickaaskas
13 (Bureau of Land Management, Hassayampa Field Office, Phoenix, Ariz.) to J. May (Argonne
14 National Laboratory, Denver, Colo.), July 29, 2010.
15

16 Beacon Solar, LLC, 2008, *Application for Certification for the Beacon Solar Energy Project*,
17 submitted to the California Energy Commission, March. Available at [http://www.energy.ca.gov/](http://www.energy.ca.gov/sitingcases/beacon/index.html)
18 [sitingcases/beacon/index.html](http://www.energy.ca.gov/sitingcases/beacon/index.html).
19

20 Bean, L.J., et al., 1978, *Persistence and Power: A Study of Native American Peoples in the*
21 *Sonoran Desert and the Devers-Palo Verde High Voltage Transmission Line*, prepared by
22 Cultural Systems Research, Incorporated, Menlo Park, Calif., for the Southern California
23 Edison Company.
24

25 Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control
26 Engineering, Washington, D.C.
27

28 Bischoff, M.C., 2000, *The Desert Training Center/California–Arizona Maneuver Area,*
29 *1942–1944: Historic and Archaeological Contexts*, Technical Series 75, Statistical Research,
30 Inc., Tucson, Ariz., prepared for the Bureau of Land Management, California Desert District.
31

32 Bisdorf, R.J., 1982, *Schlumberger Sounding Investigations in the Date Creek Basin, Arizona,*
33 U.S. Geological Survey Open File Report 82-953.
34

35 BLM (Bureau of Land Management), 1980, *Green River—Hams Fork Draft Environmental*
36 *Impact Statement: Coal*, Denver, Colo.
37

38 BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale*
39 *Leasing Program*, Colorado State Office, Denver, Colo., Jan.
40

41 BLM, 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24,
42 U.S. Department of the Interior.
43

44 BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410-1, Release 8-28,
45 U.S. Department of the Interior, Jan.
46

1 BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30,
2 U.S. Department of the Interior, Jan.
3
4 BLM, 1993, *Kingman Resource Area Proposed Resource Management Plan and Final*
5 *Environmental Impact Statement*, U.S. Department of the Interior, Kingman Resource Area,
6 Ariz., Sept.
7
8 BLM, 1996, *White River Resource Area Proposed Resource Management Plan and Final*
9 *Environmental Impact Statement*, Colorado State Office, White River Resource Area, Craig
10 District, Colo., June.
11
12 BLM, 2000, *Tres Alamos Wilderness Management Plan and Environmental Assessment*,
13 U.S. Department of the Interior, Kingman Field Office, Ariz., Sept.
14
15 BLM, 2001, *Arizona Water Rights Fact Sheet*. Available at [http://www.blm.gov/nstc/](http://www.blm.gov/nstc/WaterLaws/arizona.html)
16 [WaterLaws/arizona.html](http://www.blm.gov/nstc/WaterLaws/arizona.html).
17
18 BLM, 2006, *Lake Havasu Field Office Proposed Resource Management Plan and Final*
19 *Environmental Impact Statement*, Bureau of Land Management, Lake Havasu Field Office, Lake
20 Havasu City, Ariz., Sept.
21
22 BLM, 2007a, *Lake Havasu Field Office Record of Decision and Approved Management Plan*,
23 Lake Havasu City, Ariz., May. Available at [http://www.blm.gov/az/st/en/info/nepa/](http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/LHFO_ROD_07.html)
24 [environmental_library/arizona_resource_management/LHFO_ROD_07.html](http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/LHFO_ROD_07.html).
25
26 BLM, 2007b, *Potential Fossil Yield Classification (PFYC) System for Paleontological Resources*
27 *on Public Lands*, Instruction Memorandum No. 2008-009, with attachments, Washington, D.C.,
28 Oct. 15.
29
30 BLM, 2008a, *Assessment and Mitigation of Potential Impacts to Paleontological Resources*,
31 Instruction Memorandum No. 2009-011, with attachments, Washington, D.C., Oct. 10.
32
33 BLM, 2008b, *Agua Fria National Monument and Bradshaw-Harquahala Planning Area*
34 *Proposed Resource Management Plans and Final Environmental Impact Statement*, Phoenix
35 District Office, Phoenix, Ariz., June.
36
37 BLM, 2008c, *Special Status Species Management*, BLM Manual 6840, Release 6-125,
38 U.S. Department of the Interior, Dec. 12.
39
40 BLM, 2009a, *Rangeland Administration System*. Available at <http://www.blm.gov/ras/index.htm>.
41 Last updated Aug. 24, 2009. Accessed March 14, 2010.
42
43 BLM, 2009b, *Harcuvar Mountains Wilderness Management Plan and Environmental*
44 *Assessment*, U.S. Department of the Interior, Lake Havasu Field Office, Ariz., March.
45

1 BLM, 2010a, *Sonoran Solar Energy Project: Draft Environmental Impact Statement*. Available
2 at http://www.blm.gov/az/st/en/prog/energy/solar/sonoran_solar/maps/DEIS.html.
3

4 BLM, 2010b, *Bradshaw–Haquahala Record of Decision-Approved Resource Management Plan*,
5 Hassayapa Field Office, Phoenix, April 22. Available at [https://www.blm.gov/epl-front-](https://www.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage¤tPageId=10422)
6 [office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage¤tPageId](https://www.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage¤tPageId=10422)
7 [=10422](https://www.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage¤tPageId=10422).
8

9 BLM, 2010c, *Wild Horse and Burro Statistics and Maps*, Washington, D.C. Available at
10 [http://www.blm.gov/wo/st/en/prog/wild_horse_and_burro/wh_b_information_center/statistics_](http://www.blm.gov/wo/st/en/prog/wild_horse_and_burro/wh_b_information_center/statistics_and_maps/ha_and_hma_data.html)
11 [and_maps/ha_and_hma_data.html](http://www.blm.gov/wo/st/en/prog/wild_horse_and_burro/wh_b_information_center/statistics_and_maps/ha_and_hma_data.html). Accessed June 25, 2010.
12

13 BLM, 2010d, *Record of Decision and Approved Resource Management Plan*, Bradshaw–
14 Harquahala Planning Area.
15

16 BLM, 2010e, *Visual Resource Inventory*, prepared for U.S. Department of the Interior Bureau of
17 Land Management, Needles Field Office, Needles, Calif., Sept.
18

19 BLM, 2010f, *Solar Energy Interim Rental Policy*, U.S. Department of the Interior. Available at
20 [http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos and Bulletins/national](http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-141.html)
21 [instruction/2010/IM_2010-141.html](http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-141.html).
22

23 BLM and USFS (U.S. Forest Service), 2010a, *GeoCommunicator: Mining Claim Map*. Available
24 at <http://www.geocommunicator.gov/GeoComm/index.shtm>. Accessed June 21, 2010.
25

26 BLM and USFS, 2010b, *GeoCommunicator: Energy Map*. Available at
27 <http://www.geocommunicator.gov/GeoComm/index.shtm>. Accessed June 21, 2010.
28

29 BLM and USFS, 2010c, *GeoCommunicator: Public Land Survey System*. Available at
30 [http://www.geocommunicator.gov/ GeoComm/index.shtm](http://www.geocommunicator.gov/GeoComm/index.shtm). Accessed April 29, 2010.
31

32 Brennan, T.C., 2008, *Online Field Guide to the Reptiles and Amphibians of Arizona*. Available at
33 <http://www.reptilesfaz.org/index.html>. Accessed July 16, 2010.
34

35 BTS (Bureau of Transportation Statistics), 2009, *Air Carriers: T-100 Domestic Segment*
36 *(All Carriers)*, Research and Innovative Technology Administration, U.S. Department of
37 Transportation, Dec. Available at http://www.transtats.bts.gov/Fields.asp?Table_ID=311.
38 Accessed March 5, 2010.
39

40 CalPIF (California Partners in Flight), 2009, *The Desert Bird Conservation Plan: A Strategy*
41 *for Protecting and Managing Desert Habitats and Associated Birds in California, Ver. 1.0*.
42 Available at <http://www.prbo.org/calpif/plans.html>. Accessed March 3, 2010.
43

44 CAP (Central Arizona Project), 2010, *Central Arizona Project*. Available at [http://www.cap-](http://www.cap-az.com/)
45 [az.com/](http://www.cap-az.com/). Accessed July 15, 2010.
46

1 CDC (Centers for Disease Control and Prevention), 2009, *Divorce Rates by State: 1990, 1995,*
2 *1999–2007*. Available at [http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090](http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf)
3 [%2095%20and%2099-07.pdf](http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf).
4

5 CDFG (California Department of Fish and Game), 2008, *Life History Accounts and Range*
6 *Maps—California Wildlife Habitat Relationships System*, Sacramento, Calif. Available at
7 <http://dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx>. Accessed Feb. 19, 2010.
8

9 CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance under the*
10 *National Environmental Policy Act*, Executive Office of the President, Washington, D.C., Dec.
11 Available at <http://www.whitehouse.gov/CEQ>.
12

13 Chase, M.K., and G.R. Geupel, 2005, “The Use of Avian Focal Species for Conservation
14 Planning in California,” pp. 130–142 in *Bird Conservation Implementation and Integration*
15 *in the Americas: Proceedings of the Third International Partners in Flight Conference*,
16 March 20–24, 2002, Asilomar, Calif., Vol. 1, Gen. Tech. Rep. PSW-GTR-191, C.J. Ralph and
17 T.D. Rich (editors), U.S. Department of Agriculture, Forest Service, Pacific Southwest Research
18 Station, Albany, Calif.
19

20 City of Prescott, 2010, *Passengers—Book a Flight*. Available at [http://www.cityofprescott.net/](http://www.cityofprescott.net/services/airport/flight.php)
21 [services/airport/flight.php](http://www.cityofprescott.net/services/airport/flight.php). Accessed July 26, 2010.
22

23 Cowherd, C., et al., 1988, *Control of Open Fugitive Dust Sources*, EPA 450/3-88-008,
24 U.S. Environmental Protection Agency, Research Triangle Park, N.C.
25

26 CSC (Coastal Services Center), 2010, *Historical Hurricane Tracks*, National Oceanic and
27 Atmospheric Administration. Available at <http://csc-s-maps-q.csc.noaa.gov/hurricanes/>. Accessed
28 July 20, 2010.
29

30 Desert Tortoise Council, 1994 (Revised 1999), *Guidelines for Handling Desert Tortoises during*
31 *Construction Projects*, E.L. LaRue, Jr. (editor), Wrightwood, Calif.
32

33 DOE (U.S. Department of Energy), 2009, *Report to Congress, Concentrating Solar Power*
34 *Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power*
35 *Electricity Generation*, Jan. 13.
36

37 DOE, 2010, *DSIRE: Database of State Incentives for Renewables & Efficiency*. Available at
38 [http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=](http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ03R&re=1&ee=1)
39 [AZ03R&re=1&ee=1](http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ03R&re=1&ee=1). Accessed July 14, 2010.
40

41 EIA (Energy Information Administration), 2009, *Annual Energy Outlook 2009 with Projections*
42 *to 2030*, DOE/EIA-0383, March.
43

44 Eldred, K.M., 1982, “Standards and Criteria for Noise Control—An Overview,” *Noise Control*
45 *Engineering* 18(1):16–23.
46

1 EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental*
2 *Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*,
3 EPA-550/9-74-004, Washington, D.C., March. Available at [http://www.nonoise.org/library/](http://www.nonoise.org/library/levels74/levels74.htm)
4 [levels74/levels74.htm](http://www.nonoise.org/library/levels74/levels74.htm). Accessed Nov. 17, 2008.
5
6 EPA, 2002, *Primary Distinguishing Characteristics of Level III Ecoregions of the Continental*
7 *United States, Draft*. Available at http://www.epa.gov/wed/ecoregions/us/useco_desc.doc.
8 Accessed Oct. 2, 2008.
9
10 EPA, 2007, *Level III Ecoregions*, Western Ecology Division, Corvallis, Ore. Available at
11 http://www.epa.gov/wed/pages/ecoregions/level_iii.htm. Accessed Oct. 2, 2008.
12
13 EPA, 2009a, *Energy CO₂ Emissions by State*. Available at [http://www.epa.gov/climatechange/](http://www.epa.gov/climatechange/emissions/state_energyco2inv.html)
14 [emissions/state_energyco2inv.html](http://www.epa.gov/climatechange/emissions/state_energyco2inv.html), last updated June 12, 2009. Accessed June 23, 2009.
15
16 EPA, 2009b, *Preferred/Recommended Models—AERMOD Modeling System*. Available at
17 http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed Nov. 8, 2009.
18
19 EPA, 2009c, *eGRID*. Available at [http://www.epa.gov/cleanenergy/energy-resources/egrid/](http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html)
20 [index.html](http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html), last updated Oct. 16, 2008. Accessed Jan. 12, 2009.
21
22 EPA, 2009d, *National Primary Drinking Water Regulations and National Secondary Drinking*
23 *Water Regulation*. Available at <http://www.epa.gov/safewater/standard/index.html>.
24
25 EPA, 2010a, *National Ambient Air Quality Standards (NAAQS)*. Available at [http://www.epa.](http://www.epa.gov/air/criteria.html)
26 [gov/air/criteria.html](http://www.epa.gov/air/criteria.html), last updated June 3, 2010. Accessed June 4, 2010.
27
28 EPA, 2010b, *AirData: Access to Air Pollution Data*. Available at <http://www.epa.gov/oar/data/>.
29 Accessed July 20, 2010.
30
31 FAA (Federal Aviation Administration), 2010, *Airport Data (5010) & Contact Information,*
32 *Information Current as of 06/03/2010*. Available at [http://www.faa.gov/airports/airport_safety/](http://www.faa.gov/airports/airport_safety/airportdata_5010)
33 [airportdata_5010](http://www.faa.gov/airports/airport_safety/airportdata_5010). Accessed July 19, 2010.
34
35 Farish, T.E., 1915, *History of Arizona*, Filmer Brothers Electrotpe Company, San Francisco,
36 Calif.
37
38 Fellows, L.D., 2000, “Volcanism in Arizona,” *Arizona Geology* 30(4):1–4. Available at
39 http://www.azgs.gov/hazards_volcanoes.shtml. Accessed July 22, 2010.
40
41 FEMA (Federal Emergency Management Agency), 2009, *FEMA Map Service Center*.
42 Available at [http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=](http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1)
43 [10001&catalogId=10001&langId=-1](http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1). Accessed Nov. 20, 2009.
44
45 Field, K.J., et al. 2007, “Return to the Wild: Translocation as a Tool in Conservation of the
46 Desert Tortoise (*Gopherus agassizii*),” *Biological Conservation* 136: 232–245.

1 Fire Departments Network, 2009, *Fire Departments by State*. Available at <http://www.firedepartments.net>.
2
3
4 Freeport-McMoRan, 2010, *Freeport McMoRan Copper and Gold*. Available at http://www.fcx.com/operations/USA_Arizona_Bagdad.htm. Accessed July 28, 2010.
5
6
7 Freethy, G.W., and T.W. Anderson, 1986, *Predevelopment Hydrologic Conditions in the Alluvial Basins of Arizona and Adjacent Parts of California and New Mexico*, USGS Hydrologic Investigations Atlas HA-664.
8
9
10
11 Galloway, D., et al., 1999, *Land Subsidence in the United States*, U.S. Geological Survey Circular 1182.
12
13
14 GCRP (U.S. Global Change Research Program), 2009, *Global Climate Change Impacts in the United States: A State of Knowledge Report from the U.S. Global Change Research Program*. Cambridge University Press, Cambridge, Mass. Available at <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>. Accessed Jan. 25, 2010.
15
16
17
18
19 Giffen, R., 2009, “Rangeland Management Web Mail,” personal communication from R. Giffen (USDA Forest Service, Rangelands Management, Washington, D.C.) to W. Vinikour (Argonne National Laboratory, Argonne, Ill.), Sept. 22.
20
21
22
23 Gifford, E.W., 1936, “The Northeastern and Western Yavapai,” *University of California Publications in American Archaeology and Anthropology* 34:247–354, University of California Press, Berkeley.
24
25
26
27 Hanson, C.E., et al., 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, prepared by Harris Miller Miller & Hanson Inc., Burlington, Mass., for U.S. Department of Transportation, Federal Transit Administration, Washington, D.C., May. Available at http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.
28
29
30
31
32 Hoffmeister, D.F., 1986, *Mammals of Arizona*, University of Arizona Press, Tucson, Ariz.
33
34 Holden, J., 2010, personal communication from Holden (Bureau of Land Management, Hassayampa Field Office, Phoenix, Ariz.) to J. May (Argonne National Laboratory, Lakewood, Colo.), July 29, 2010.
35
36
37
38 Jackson, M., Sr., 2009, “Quechan Indian Tribe’s Comments on Programmatic Environmental Impact Statement for Solar Energy Development,” letter from Jackson (President, Quechan Indian Tribe, Fort Yuma, Ariz.) to Argonne National Laboratory (Argonne, Ill.), Sept. 3.
39
40
41
42 Jeter, M.D., 1977, *Archaeology in Copper Basin, Yavapai County, Arizona: Model Building for the Prehistory of the Prescott Region*. Arizona State University, Anthropological Research Paper No. 11.
43
44
45

1 Kenny, J. F., et al., 2009, *Estimated Use of Water in the United States in 2005*, U.S. Geological
2 Survey, Circular 1344. Available at <http://pubs.usgs.gov/circ/1344>. Accessed Jan. 4, 2010.
3

4 Kessell, J.L., 2002, *Spain in the Southwest*, University of Oklahoma Press, Norman, Okla.
5

6 Khera, S., and P.S. Mariella, 1983, “Yavapai,” pp. 38–54 in *Handbook of North American*
7 *Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington D.C.
8

9 Lavelle, J., 2006, *Arizona Water Resources and Issues*, Border Governor’s Conference-Water
10 Table, May 8.
11

12 Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*,
13 Bonneville Power Administration, Portland, Ore., Dec.
14

15 Levick, L., et al., 2008, *The Ecological and Hydrological Significance of Ephemeral and*
16 *Intermittent Streams in the Arid and Semi-arid American Southwest*. U.S. Environmental
17 Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134,
18 ARS/233046.
19

20 Lovich, J., and D. Bainbridge, 1999, “Anthropogenic Degradation of the Southern California
21 Desert Ecosystem and Prospects for Natural Recovery and Restoration,” *Environmental*
22 *Management* 24(3):309–326.
23

24 Lynch, D.J., 1982, “Volcanic Processes in Arizona,” *Fieldnotes from the Arizona Bureau of*
25 *Geology and Mineral Technology* 12(3):1–8. Available at [http://www.azgs.az.gov/hazards_](http://www.azgs.az.gov/hazards_volcanoes.shtml)
26 [volcanoes.shtml](http://www.azgs.az.gov/hazards_volcanoes.shtml). Accessed July 22, 2010.
27

28 Ludington, S. et al., 2007, *Preliminary Integrated Geologic Map Databases for the United States*
29 *– Western States: California, Nevada, Arizona, Washington, Oregon, Idaho, and Utah*,
30 U.S. Geological Survey Open File Report 2005-1305, Version 1.3, original file updated
31 Dec. 2007. Available at <http://pubs.usgs.gov/of/2005/1305/index.htm>.
32

33 Mancini, K.M., et al., 1988, *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and*
34 *Wildlife: A Literature Synthesis*, NERC-88/29, U.S. Fish and Wildlife Service National Ecology
35 Research Center, Ft. Collins, Colo.
36

37 Mao, F., 2010, personal communication from F. Mao (Arizona Department of Environmental
38 Quality, Phoenix, Ariz.) to Y.-S. Chang (Argonne National Laboratory, Argonne, Ill.), July 17.
39

40 Martin, P.S., and F. Plog, 1973, *The Archaeology of Arizona: A Study of the Southwest Region*,
41 Doubleday/Natural History Press, Garden City, N.Y.
42

43 Matson, R.G., 1991, *The Origins of Southwest Agriculture*, University of Arizona Press,
44 Tucson, Ariz.
45

1 McGuire, R., and M. Schiffer, 1982, *Hohokam and Patayan: Prehistory of Southwestern*
2 *Arizona*, Academic Press, New York, N.Y.
3

4 MIG (Minnesota IMPLAN Group), Inc., 2010, *State Data Files*, Stillwater, Minn.
5

6 Miller, N.P., 2002, “Transportation Noise and Recreational Lands,” in *Proceedings of Inter-*
7 *Noise 2002*, Dearborn, Mich., Aug. 19–21. Available at [http://www.hmmh.com/cmsdocuments/](http://www.hmmh.com/cmsdocuments/N011.pdf)
8 [N011.pdf](http://www.hmmh.com/cmsdocuments/N011.pdf). Accessed Aug. 30, 2007.
9

10 Moose, V., 2009, “Comments on Solar Energy Development Programmatic EIS,” letter from
11 Moose (Tribal Chairperson, Big Pine Paiute Tribe of the Owens Valley, Big Pine, Calif.) to
12 Argonne National Laboratory (Argonne, Ill.), Sept. 14.
13

14 Morgan, G.S., and R.S. White, Jr., 2005, “Miocene and Pliocene Vertebrates from Arizona,”
15 pp 114–135 in *Vertebrate Paleontology in Arizona*, Heckert, A.B., and S.G. Lucas (editors),
16 New Mexico Museum of Natural History and Science Bulletin No. 29.
17

18 National Research Council, 1996, *Alluvial Fan Flooding*, Committee on Alluvial Fan Flooding,
19 Water Science and Technology Board, and Commission on Geosciences, Environment, and
20 Resources, National Academies Press, Washington, D.C.
21

22 NatureServe, 2010, *NatureServe Explorer: An Online Encyclopedia of Life*. Available at
23 <http://www.natureserve.org/explorer/>. Accessed March 4, 2010.
24

25 NCDC (National Climatic Data Center), 2010a, *Climates of the States (CLIM60): Climate of*
26 *Arizona*, National Oceanic and Atmospheric Administration, Satellite and Information Service.
27 Available at <http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl>. Accessed
28 July 10, 2010.
29

30 NCDC, 2010b, *Storm Events*, National Oceanic and Atmospheric Administration, Satellite and
31 Information Service. Available at [http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent](http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms)
32 [~Storms](http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms). Accessed July 20, 2010.
33

34 NCES (National Center for Education Statistics), 2009, *Search for Public School Districts*,
35 U.S. Department of Education. Available at <http://www.nces.ed.gov/ccd/districtsearch>.
36

37 Neusius, S.W., and G.T. Gross, 2007, “Mobility, Flexibility, and Persistence in the Great Basin,”
38 in *Seeking Our Past*, Oxford University Press, New York, N.Y.
39

40 Ninyo and Moore, 2007, *Geotechnical Evaluation – Bullard Wash Basins, McDowell Road*
41 *Commercial Corridor, Goodyear, Arizona*, prepared for Wood/Patel and Associates, Inc., June 4.
42

43 NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO)*
44 *Database for Maricopa County, Arizona*. Available at: <http://SoilDataMart.nrcs.usds.gov>.
45

1 NRCS, 2010, *Custom Soil Resource Report for Maricopa County* (covering the proposed Bullard
2 Wash SEZ), Arizona, U.S. Department of Agriculture, Washington, D.C., Oct. 7.
3

4 NROSL (Northwest Regional Obsidian Sourcing Laboratory), 2009, *Nevada Obsidian Sources*.
5 Available at http://www.obsidianlab.com/image_maps/map_obsidian_arizona.jpg.
6

7 Nussear, K.E., et al., 2009, *Modeling Habitat for the Desert Tortoise (Gopherus agassizii) in*
8 *the Mojave and Parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona*,
9 U.S. Geological Survey Open-File Report 2009-1102.
10

11 Otton, J.K., and W.E. Brooks, Jr., 1978, "Tectonic History of the Colorado Plateau Margin, Date
12 Creek Basin and Adjacent Areas, West-Central Arizona," pp. 31–33 in papers presented to the
13 Conference on Plateau Uplift: Mode and Mechanism. Available at [http://www.adsabs.harvard.](http://www.adsabs.harvard.edu/)
14 [edu/](http://www.adsabs.harvard.edu/). Accessed July 27, 2010.
15

16 Otton, J.K., and J.C. Wynn, 1978, *Geologic Interpretation of Gravity Data from the Date*
17 *Creek Basin and Adjacent Area, West-Central Arizona*, U.S. Geological Survey Open File
18 Report 78-845.
19

20 Pearthree, P.A. (compiler), 1998, *Fault Number 951–Big Chino Fault (Class A)*, in Quaternary
21 Fault and Fold Database of the United States, U.S. Geological Survey Web site. Available at
22 <http://earthquakes.usgs.gov/regional/qfaults>. Accessed July 27, 2010.
23

24 RailAmerica, 2010, *Arizona and California Railroad*. [http://www.railamerica.com/RailServices/](http://www.railamerica.com/RailServices/ARZC.aspx)
25 [ARZC.aspx](http://www.railamerica.com/RailServices/ARZC.aspx). Accessed Feb. 26, 2010.
26

27 Reid, J., and S. Whittlesey, 1997, *The Archaeology of Ancient Arizona*, University of Arizona
28 Press, Tucson, Ariz.
29

30 Richard, S.M., et al., 2000, *Geologic Map of Arizona (Scale 1:1,000,000)*, Arizona Geological
31 Survey Map M-35. Available at http://www.azgs.state.az.us/services_azgeomapve.shtml.
32 Accessed Oct. 20, 2010.
33

34 Robson, S.G., and E.R. Banta, 1995, *Ground Water Atlas of the United States: Arizona,*
35 *Colorado, New Mexico, Utah*, U.S. Geological Survey, HA 730-C.
36

37 Royster, J., 2008, "Indian Land Claims," pp. 28–37 in *Handbook of North American Indians,*
38 *Vol. 2, Indians in Contemporary Society*, G.A. Bailey (editor), Smithsonian Institution,
39 Washington, D.C.
40

41 SAMHSA (Substance Abuse and Mental Health Services Administration), 2009, *National*
42 *Survey on Drug Use and Health, 2004, 2005 and 2006*, Office of Applied Studies,
43 U.S. Department of Health and Human Services. Available at [http://oas.samhsa.gov/](http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage)
44 [substate2k8/StateFiles/TOC.htm#TopOfPage](http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage).
45

1 Schwartz, S., 2009, "Arizona TES Data Request," personal communication from Schwartz
2 (HDMS Program Supervisor, Arizona Game and Fish Department, Phoenix, Ariz.) to L. Walston
3 (Argonne National Laboratory, Argonne, Ill.), July 29.
4

5 SES (Stirling Energy Systems) Solar Two, LLC, 2008, *Application for Certification*, submitted
6 to the Bureau of Land Management, El Centro, Calif., and the California Energy Commission,
7 Sacramento, Calif., June. Available at [http://www.energy.ca.gov/sitingcases/solartwo/
8 documents/applicant/afc/index.php](http://www.energy.ca.gov/sitingcases/solartwo/documents/applicant/afc/index.php). Accessed Oct. 1, 2008.
9

10 Shafroth, P.B., and V.B. Beauchamp, 2006, *Defining Ecosystem Flow Requirements for the Bill
11 Williams River, Arizona*, U.S. Geological Survey Open File Report 2006-1314. Available at
12 <http://www.fort.usgs.gov/products/publications/21745/21745.pdf>.
13

14 Sharp, 2008, *Sharp Solar Power System Installed for Arizona Public Service*. Available at
15 [http://docs.google.com/viewer?a=v&q=cache:CyU42NfkdwAJ:www.sharppusa.com/
16 SolarElectricity/SolarForCommercial/~/_media/Files/Solar/Solar_CaseStudy/sol_dow_Arizona_
17 Case_Study.ashx+prescott+airport+solar&hl=en&gl=us&pid=bl&srcid=ADGEEsGkeMEsYtJd5s00gnJ9gomJstbZBXP55SkJ8AzzPMjciMeqiSoE4gluWrM_0BQ6qwxYVvsFpeJVrK3Fd1IE
18 q2y0KyUa5pIM5jUAF0FDZSJ2uFvgavy-C6BYh5bxVY_u7pVW0i&sig=AHIEtbT-NaytLpb_
19 8V9_cJz1ShDC8y9xcQ](http://docs.google.com/viewer?a=v&q=cache:CyU42NfkdwAJ:www.sharppusa.com/SolarElectricity/SolarForCommercial/~/_media/Files/Solar/Solar_CaseStudy/sol_dow_Arizona_Case_Study.ashx+prescott+airport+solar&hl=en&gl=us&pid=bl&srcid=ADGEEsGkeMEsYtJd5s00gnJ9gomJstbZBXP55SkJ8AzzPMjciMeqiSoE4gluWrM_0BQ6qwxYVvsFpeJVrK3Fd1IEq2y0KyUa5pIM5jUAF0FDZSJ2uFvgavy-C6BYh5bxVY_u7pVW0i&sig=AHIEtbT-NaytLpb_8V9_cJz1ShDC8y9xcQ). Accessed July 28, 2010.
20

21

22 Sheridan, T.E., 1995, *Arizona: A History*, University of Arizona Press, Tucson, Ariz.
23

24 Shipman, T.C., and M. Diaz, 2008, *Arizona's Earth Fissure Mapping Program: Protocols,
25 Procedures, and Products*, Arizona Geological Survey Open File Report 08-03.
26

27 Smith, M. D., et al., 2001, "Growth, Decline, Stability and Disruption: A Longitudinal Analysis
28 of Social Well-Being in Four Western Communities," *Rural Sociology* 66:425-450.
29

30 Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians*, Houghton Mifflin
31 Company, Boston and New York.
32

33 Stoffle, R.W., et al., 1990, *Native American Cultural Resource Studies at Yucca Mountain,
34 Nevada*, University of Michigan, Ann Arbor, Mich.
35

36 Stone, C.L., 1982, "Historical Overview of Central Western Arizona: Non-aboriginal Use of the
37 Desert," In *Granite Reef, A Study in Desert Archaeology*, P.E. Brown and C.L. Stone (editors),
38 Anthropological Research Paper No. 28, Arizona State University, Tempe, Ariz.
39

40 Stone, C.L., 1986, *Deceptive Desolation: Prehistory of the Sonoran Desert in West Central
41 Arizona, Cultural Resource Series No. 1*, Bureau of Land Management, Phoenix, Ariz.
42

43 Stout, D., 2009, personal communication from Stout (U.S. Fish and Wildlife Service, Acting
44 Assistant Director for Fisheries and Habitat Conservation, Washington, D.C.) to L. Jorgensen
45 (Bureau of Land Management, Washington, D.C.) and L. Resseguie (Bureau of Land
46 Management Washington, D.C.), Sept. 14.

1 Turner, R.M., and D.E. Brown, 1994, "Sonoran Desertscrub," in *Biotic Communities:*
2 *Southwestern United States and Northwestern Mexico*, D.E. Brown (editor), University of Utah
3 Press, Salt Lake City, Utah.
4

5 U.S. Bureau of the Census, 2009a, *County Business Patterns, 2006*, Washington, D.C. Available
6 at <http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html>.
7

8 U.S. Bureau of the Census, 2009b, *GCT-T1. Population Estimates*. Available at <http://factfinder.census.gov/>.
9

10

11 U.S. Bureau of the Census, 2009c, *QT-P32. Income Distribution in 1999 of Households and*
12 *Families: 2000. Census 2000 Summary File (SF 3) – Sample Data*. Available at
13 <http://factfinder.census.gov/>.
14

15 U.S. Bureau of the Census, 2009d, *S1901. Income in the Past 12 Months. 2006–2008 American*
16 *Community Survey 3-Year Estimates*. Available at <http://factfinder.census.gov/>.
17

18 U.S. Bureau of the Census, 2009e, *GCT-PH1. GCT-PH1. Population, Housing Units, Area, and*
19 *Density: 2000. Census 2000 Summary File (SF 1) – 100-Percent Data*. Available at
20 <http://factfinder.census.gov/>.
21

22 U.S. Bureau of the Census, 2009f, *T1. Population Estimates*. Available at <http://factfinder.census.gov/>.
23
24

25 U.S. Bureau of the Census, 2009g, *GCT2510. Median Housing Value of Owner-Occupied*
26 *Housing Units (Dollars). 2006–2008 American Community Survey 3-Year Estimates*. Available
27 at <http://factfinder.census.gov/>.
28

29 U.S. Bureau of the Census, 2009h, *QT-H1. General Housing Characteristics, 2000. Census*
30 *2000 Summary File 1 (SF 1) 100-Percent Data*. Available at <http://factfinder.census.gov/>.
31

32 U.S. Bureau of the Census, 2009i, *GCT-T9-R. Housing Units, 2008. Population Estimates*.
33 Available at <http://factfinder.census.gov/>.
34

35 U.S. Bureau of the Census, 2009j, *S2504. Physical Housing Characteristics for Occupied*
36 *Housing Units 2006–2008 American Community Survey 3-Year Estimates*. Available at
37 <http://factfinder.census.gov/>.
38

39 U.S. Bureau of the Census, 2009k, *Census 2000 Summary File 1 (SF 1) 100-Percent Data*.
40 Available at <http://factfinder.census.gov/>.
41

42 U.S. Bureau of the Census, 2009l, *Census 2000 Summary File 3 (SF 3) – Sample Data*.
43 Available at <http://factfinder.census.gov/>.
44

- 1 USDA (U.S. Department of Agriculture), 2004, *Understanding Soil Risks and Hazards—Using*
2 *Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property*, G.B. Muckel
3 (editor).
4
- 5 USDA, 2009a, *2007 Census of Agriculture: Arizona State and County Data, Vol. 1, Geographic*
6 *Area Series*, National Agricultural Statistics Service, Washington, D.C. Available at
7 [http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Arizona/index.asp)
8 [Level/Arizona/index.asp](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Arizona/index.asp).
9
- 10 USDA, 2009b, *Western Irrigated Agriculture, Data Sets*. Available at [http://www.ers.usda.gov/](http://www.ers.usda.gov/data/westernirrigation)
11 [data/westernirrigation](http://www.ers.usda.gov/data/westernirrigation). Accessed Nov. 20, 2009.
12
- 13 USDA, 2010a, *National Agricultural Statistics Service—Quick Stats, Arizona County Data*
14 *(Crops and Animals)*. Available at
15 http://www.nass.usda.gov/QuickStats/Create_County_Indv.jsp. Accessed July 23, 2010.
16
- 17 USDA, 2010b, *Plants Database*, Natural Resources Conservation Service. Available at:
18 <http://plants.usda.gov/>. Accessed June 23, 2010.
19
- 20 U.S. Department of Commerce, 2009, *Local Area Personal Income*, Bureau of Economic
21 Analysis. Available at <http://www.bea.doc.gov/bea/regional/reis/>
22
- 23 U.S. Department of the Interior, 2010, *Native American Consultation Database*, National
24 NAGPRA Online Databases. National Park Service. Available at [http://grants.cr.nps.gov/](http://grants.cr.nps.gov/nacd/index.cfm)
25 [nacd/index.cfm](http://grants.cr.nps.gov/nacd/index.cfm).
26
- 27 U.S. Department of Justice, 2008, “Table 80: Full-time Law Enforcement Employees, by State
28 by Metropolitan and Nonmetropolitan Counties, 2007,” *2007 Crime in the United States*, Federal
29 Bureau of Investigation, Criminal Justice Information Services Division, Sept. Available at
30 http://www.fbi.gov/ucr/cius2007/data/table_80.html. Accessed June 17, 2010.
31
- 32 U.S. Department of Justice, 2009a, “Table 8: Offences Known to Law Enforcement, by State and
33 City,” *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice
34 Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.
35
- 36 U.S. Department of Justice, 2009b, “Table 10: Offences Known to Law Enforcement, by State
37 and by Metropolitan and Non-metropolitan Counties,” *2008 Crime in the United States*, Federal
38 Bureau of Investigation, Criminal Justice Information Services Division. Available at
39 http://www.fbi.gov/ucr/cius2008/data/table_10.html.
40
- 41 U.S. Department of Labor, 2009a, *Local Area Unemployment Statistics: States and Selected*
42 *Areas: Employment Status of the Civilian Noninstitutional Population, 1976 to 2007, Annual*
43 *Averages*, Bureau of Labor Statistics. Available at <http://www.bls.gov/lau/staadata.txt>.
44
- 45 U.S. Department of Labor, 2009b, *Local Area Unemployment Statistics: Unemployment Rates*
46 *for States*, Bureau of Labor Statistics. Available at <http://www.bls.gov/web/laumstrk.htm>.

1 U.S. Department of Labor, 2009c, *Local Area Unemployment Statistics: County Data*, Bureau of
2 Labor Statistics. Available at <http://www.bls.gov/lau>.
3
4 USFS (U.S. Forest Service), 2007, *Wild Horse and Burro Territories*, U.S. Forest Service,
5 Rangelands, Washington, D.C. Available at [http://www.fs.fed.us/rangelands/ecology/
6 wildhorseburro//territories/index.shtml](http://www.fs.fed.us/rangelands/ecology/wildhorseburro//territories/index.shtml). Accessed Oct. 20, 2009.
7
8 USFWS (U.S. Fish and Wildlife Service), 1994, *Desert Tortoise (Mojave Population) Recovery*
9 *Plan*, U.S. Fish and Wildlife Service, Portland, Ore.
10
11 USFWS, 2009, *National Wetlands Inventory*. Available at <http://www.fws.gov/wetlands>.
12
13 USFWS, 2010a, *Environmental Conservation Online System (ECOS)*, U.S. Fish and
14 Wildlife Service. Available at <http://www.fws.gov/ecos/ajax/ecos/indexPublic.do>. Accessed
15 May 28, 2010.
16
17 USFWS, 2010b, “Endangered and Threatened Wildlife and Plants; 12-Month Finding on a
18 Petition to List the Sonoran Desert Population of the Bald Eagle as a Threatened or Endangered
19 Distinct Population Segment,” *Federal Register* 75:8601–8621.
20
21 USGS (U.S. Geological Survey), 2004, *National Gap Analysis Program, Provisional Digital*
22 *Land Cover Map for the Southwestern United States*, Version 1.0, RS/GIS Laboratory, College
23 of Natural Resources, Utah State University. Available at [http://earth.gis.usu.edu/swgap/
24 landcover.html](http://earth.gis.usu.edu/swgap/landcover.html). Accessed March 15, 2010.
25
26 USGS, 2005a, *National Gap Analysis Program, Southwest Regional GAP Analysis Project—*
27 *Land Cover Descriptions*, RS/GIS Laboratory, College of Natural Resources, Utah State
28 University. Available at http://earth.gis.usu.edu/swgap/legend_desc.html. Accessed March 15,
29 2010.
30
31 USGS, 2005b, *Southwest Regional GAP Analysis Project*, U.S. Geological Survey National
32 Biological Information Infrastructure. Available at [http://fws-nmcfwru.nmsu.edu/swregap/
33 habitatreview/Review.asp](http://fws-nmcfwru.nmsu.edu/swregap/habitatreview/Review.asp).
34
35 USGS, 2007, *National Gap Analysis Program, Digital Animal-Habitat Models for the*
36 *Southwestern United States*, Ver. 1.0, Center for Applied Spatial Ecology, New Mexico
37 Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available at
38 <http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm>. Accessed March 15, 2010.
39
40 USGS, 2008, *National Seismic Hazard Maps – Peak Horizontal Acceleration (%g) with 10%*
41 *Probability of Exceedance in 50 Years (Interactive Map)*. Available at [http://gldims.cr.usgs.gov/
42 nshmp2008/viewer.htm](http://gldims.cr.usgs.gov/nshmp2008/viewer.htm). Accessed Aug. 4, 2010.
43
44 USGS, 2010a, *National Earthquake Information Center (NEIC)–Circular Area Search (within*
45 *100-km of the center of the proposed Millers SEZ)*. Available at [http://earthquake.usgs.gov/
46 earthquakes/eqarchives/epic/epic_circ.php](http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php). Accessed July 22, 2010.

1 USGS, 2010b, *Glossary of Terms on Earthquake Maps—Magnitude*. Available at
2 <http://earthquake.usgs.gov/earthquakes/glossary.php#magnitude>. Accessed Aug. 8, 2010.
3

4 USGS, 2010c, *Water Resources of the United States—Hydrologic Unit Maps*. Available at
5 <http://water.usgs.gov/GIS/huc.html>. Accessed April 12, 2010.
6

7 USGS, 2010d, *National Water Information System*. Available at <http://wdr.water.usgs.gov/nwisgmap>. Accessed July 12, 2010.
8
9

10 USGS and AZGS (Arizona Geological Survey), 2010, *Quaternary Fault and Fold Database for*
11 *the United States*. Available at <http://earthquake.usgs.gov/regional/xfaults/>. Accessed Oct. 7,
12 2010.
13

14 WildEarth Guardians and Western Watersheds Project, 2008, *Petition to List the Sonoran Desert*
15 *Tortoise (Gopherus agassizii) under the U.S. Endangered Species Act*, petition to the U.S. Fish
16 and Wildlife Service, Oct. 9, 2008.
17

18 Wood, C.A., and J. Kienle (editors), 1992, *Volcanoes of North America*, Cambridge University
19 Press.
20

21 WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System*
22 *(EDMS)*. Available at <http://www.wrapdms.org/default.aspx>. Accessed June 4, 2009.
23

24 WRCC (Western Regional Climate Center), 2010, *Western U.S. Climate Historical Summaries*.
25 Available at <http://www.wrcc.dri.edu/Climsum.html>. Accessed July 10, 2010.
26

1 **8.3 GILLESPIE**

2
3
4 **8.3.1 Background and Summary of Impacts**

5
6
7 **8.3.1.1 General Information**

8
9 The proposed Gillespie SEZ is located in Maricopa County in west-central Arizona
10 (Figure 8.31.1-1). The SEZ has a total area of 2,618 acres (11 km²). In 2008, the county
11 population was 3,958,263. The nearest town is Arlington, about 7 mi (11 km) northeast of the
12 SEZ, with a population of less than 500, while the larger town of Buckeye is located about 17 mi
13 (27 km) northeast and has a population of more than 50,000. Phoenix, Arizona, is approximately
14 50 mi (48 km) northeast of the SEZ.

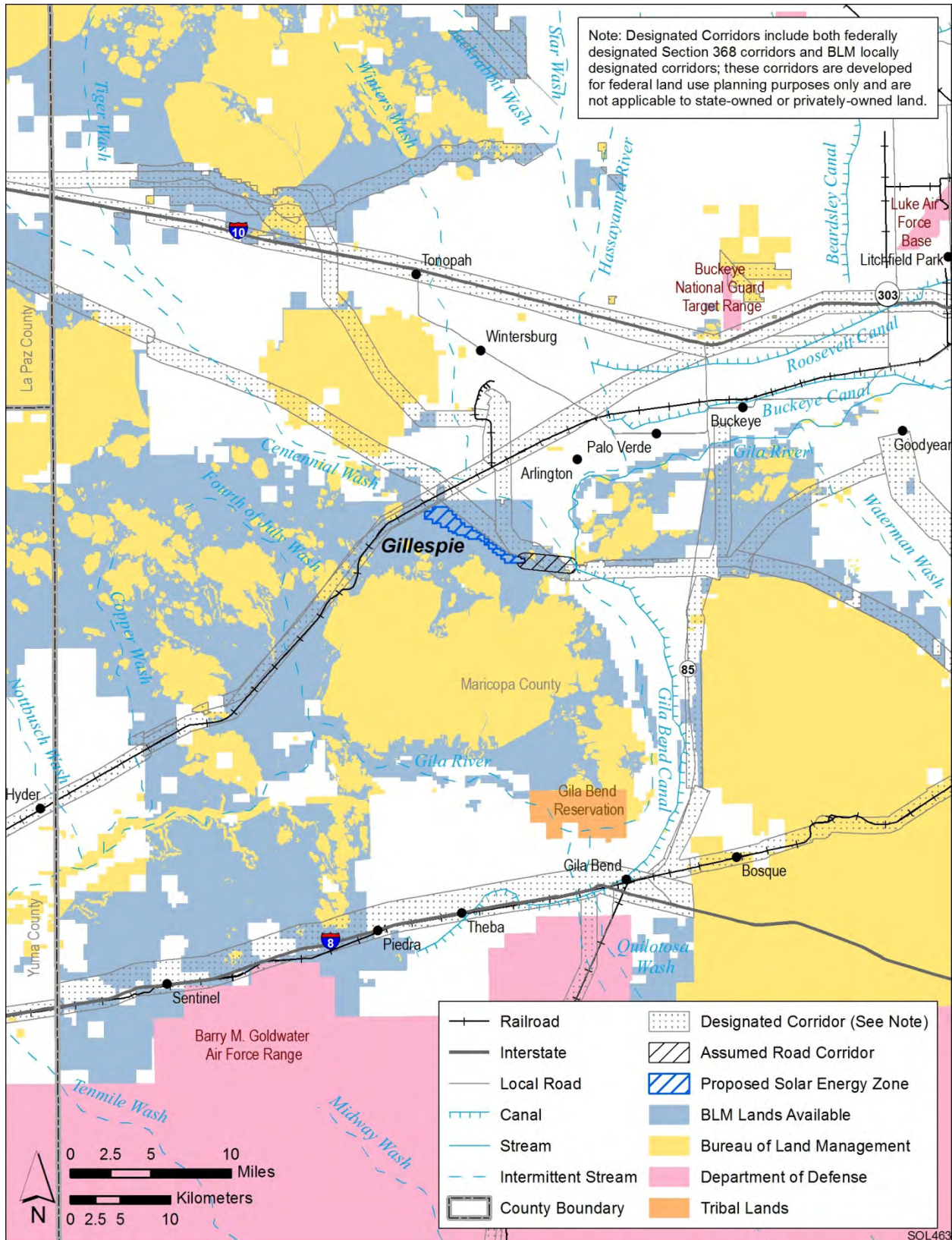
15
16 The nearest major road access to the SEZ is via Old U.S. 80, which runs north-south
17 3 mi (5 km) from the eastern tip of the Gillespie SEZ. The nearest railroad is a branch of the
18 UP Railroad that passes within 0.5 mi (0.8 km) of the northwestern edge of the SEZ, and the
19 nearest stop is in Buckeye, 20 mi (30 km) northeast of the SEZ. The nearest airport is the
20 Buckeye Municipal Airport, 20 mi (32 km) from the SEZ, which does not have scheduled
21 commercial passenger service. Phoenix Sky Harbor International Airport is located 59 mi
22 (95 km) away in Phoenix, Arizona.

23
24 A 500-kV transmission line runs within 0.5 mi (0.8 km) of the proposed SEZ. It is
25 assumed that this existing transmission line would provide access from the SEZ to the
26 transmission grid (See Section 8.3.1.1.2).

27
28 As of February 2010, there were no ROW applications for solar projects within the SEZ;
29 however, there were four ROW applications for solar projects that would be located within 50 mi
30 (80 km) of the SEZ. These applications are discussed in Section 8.3.22.2.1.

31
32 The proposed Gillespie SEZ is undeveloped and rural, with few permanent residents in
33 the immediate area. The SEZ is located to the southeast of the Harquahala Basin, in a valley
34 between the Gila Bend Mountains to the southwest and Centennial Wash to the northeast. Land
35 within the SEZ is undeveloped scrubland characteristic of a semiarid desert valley.

36
37 The proposed Gillespie SEZ and other relevant information are shown in
38 Figure 8.3.1.1-1. The criteria used to identify the proposed Gillespie SEZ as an appropriate
39 location for solar energy development included proximity to existing transmission or designated
40 corridors, proximity to existing roads, a slope of generally less than 2%, and an area of more than
41 2,500 acres (10 km²). In addition, the area was identified as being relatively free of other types
42 of conflicts, such as USFWS-designated critical habitat for threatened and endangered species,
43 ACECs, SRMAs, and NLCS lands (see Section 2.2.2.2 for the complete list of exclusions).
44 Although these classes of restricted lands were excluded from the proposed Gillespie SEZ, other
45 restrictions might be appropriate. The analyses in the following sections evaluate the affected



1

2 **FIGURE 8.3.1.1-1 Proposed Gillespie SEZ**

1 environment and potential impacts associated with utility-scale solar energy development in the
 2 proposed SEZ for important environmental, cultural, and socioeconomic resources.

3
 4 As initially announced in the *Federal Register* on June 30, 2009, the proposed Gillespie
 5 SEZ encompassed 3,970 acres (16 km²). Subsequent to the study area scoping period, the
 6 boundaries of the proposed Gillespie SEZ were altered somewhat to facilitate BLM
 7 administration of the SEZ area. The revised SEZ is approximately 1,352 acres (5.5 km²) smaller
 8 than the original SEZ as published in June 2009.

9
 10
 11 **8.3.1.2 Development Assumptions for the Impact Analysis**

12
 13 Maximum solar development of the Gillespie SEZ is assumed to be 80% of the SEZ
 14 area over a period of 20 years, a maximum of 2,094 acres (8.5 km²). These values are shown
 15 in Table 8.3.1.2-1, along with other development assumptions. Full development of the
 16 Gillespie SEZ would allow development of facilities with an estimated total of 233 MW of
 17 electrical power capacity if power tower, dish engine, or PV technologies were used, assuming
 18 9 acres/MW (0.04 km²/MW) of land required, and an estimated 419 MW of power if solar
 19 trough technologies were used, assuming 5 acres/MW (0.02 km²/MW) of land required.

20
 21 Availability of transmission from SEZs to load centers will be an important consideration
 22 for future development in SEZs. The nearest existing transmission line is a 500-kV line that runs
 23 less than 1 mi (1.6 km) west of the SEZ. At full build-out capacity, it is possible that new
 24
 25

TABLE 8.3.1.2-1 Proposed Gillespie SEZ—Assumed Development Acreages, Solar MW Output, Access Roads, and Transmission Line ROWs

Total Acreage and Assumed Developed Acreage (80% of Total)	Assumed Maximum SEZ Output for Various Solar Technologies	Distance to Nearest State, U.S. or Interstate Highway	Distance and Capacity of Nearest Existing Transmission Line	Assumed Area of Transmission Line and Road ROW	Distance to Nearest Designated Corridor ^e
2,618 acres and 2,094 acres ^a	233 MW ^b and 419 MW ^c	Old U.S. 80 3 mi ^d	<1 mi and 500 kV	0 acres and 22 acres	Adjacent

- a To convert acres to km², multiply by 0.004047.
- b Maximum power output if the SEZ were fully developed using power tower, dish engine, or PV technologies, assuming 9 acres/MW (0.04 km²/MW) of land required.
- c Maximum power output if the SEZ were fully developed using solar trough technologies, assuming 5 acres/MW (0.02 km²/MW) of land required.
- d To convert mi to km, multiply by 1.609.
- e BLM-designated corridors are developed for federal land use planning purposes only and are not applicable to state-owned or privately owned land.

1 transmission and/or upgrades of existing transmission lines would be required to bring electricity
2 from the proposed Gillespie SEZ to load centers; however, at this time the location and size of
3 such new transmission facilities are unknown. Generic impacts of transmission and associated
4 infrastructure construction and of line upgrades for various resources are discussed in Chapter 5.
5 Project-specific analyses would need to identify the specific impacts of new transmission
6 construction and line upgrades for any projects proposed within the SEZ.
7

8 For purposes of analysis in the PEIS, it was assumed that the existing 500-kV
9 transmission line, which runs very close to the proposed SEZ (within 0.5 mi [0.8 km]), could
10 provide access to the transmission grid, and thus no additional acreage disturbance for
11 transmission line access was assessed. Access to the existing transmission line was assumed,
12 without additional information on whether this line would be available for connection of future
13 solar facilities. If a connecting transmission line were constructed in the future to connect
14 facilities within the SEZ to a different off-site grid location from the one assumed here, site
15 developers would need to determine the impacts from construction and operation of that line. In
16 addition, developers would need to determine the impacts of line upgrades if they are needed.
17

18 An additional 22 acres (0.9 km²) would be needed for new road access to support solar
19 energy development in the Gillespie SEZ, as summarized in Table 8.3.1.2-1. This estimate was
20 based on the assumption that a new 3-mi (5-km) access road to the nearest major road, Old
21 U.S. 80, would support construction and operation of solar facilities.
22
23

24 **8.3.1.3 Summary of Major Impacts and SEZ-Specific Design Features**

25

26 In this section, the impacts and SEZ-specific design features assessed in Sections 8.3.2
27 through 8.3.21 for the proposed Gillespie SEZ are summarized in tabular form. Table 8.3.1.3-1 is
28 a comprehensive list of impacts discussed in these sections; the reader may reference the
29 applicable sections for detailed support of the impact assessment. Section 8.3.22 discusses
30 potential cumulative impacts from solar energy development in the proposed SEZ.
31

32 Only those design features specific to the proposed Gillespie SEZ are included in
33 Sections 8.3.2 through 8.3.21 and in the summary table. The detailed programmatic design
34 features for each resource area to be required under BLM's Solar Energy Program are presented
35 in Appendix A, Section A.2.2. These programmatic design features would also be required for
36 development in this and other SEZs.
37
38
39
40

TABLE 8.3.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Gillespie SEZ and SEZ-Specific Design Features^a

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Lands and Realty	<p>Full development of the SEZ could disturb up to 2,618 acres (11 km²). Development of the SEZ for utility-scale solar energy production would establish a large, isolated industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Since the SEZ is rural and undeveloped, utility-scale solar energy development would be a new and dominant land use in the area.</p> <p>Construction of a new 3-mi (5-km) road to connect the south end of the SEZ to Old U.S. 80 would result in new surface disturbance of about 20 acres (0.1 km²) of public land.</p>	<p>None.</p> <p>Priority consideration should be given to utilizing Agua Caliente Road to provide construction and operational access to the SEZ.</p>
Specially Designated Areas and Lands with Wilderness Characteristics	<p>Wilderness values in the Woolsey Peak and Signal Mountain WAs between 2 and 7 mi (3 and 11 km) and 3.5 to 7 mi (6 to 11 km) respectively, of the border of the SEZ and within the viewshed of the SEZ would be adversely affected. Solar development in the SEZ would contribute to a further reduction in the scenic viewshed of the Saddle Mountain SRMA. The new access road would contribute additional adverse impacts on wilderness values in the Woolsey Peak WA.</p>	<p>Requiring that the solar technologies with lower profiles be used within the SEZ would substantially reduce visual impacts on wilderness and scenic resources.</p>
Rangeland Resources: Livestock Grazing	<p>There would be a 14.6% reduction in future ephemeral grazing authorizations in the Layton allotment.</p>	<p>Development of range improvements and changes in grazing management should be considered to mitigate the loss of AUMs in the grazing allotment.</p>
Rangeland Resources: Wild Horses and Burros	<p>None.</p>	<p>None.</p>

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Recreation	Areas developed for solar energy production would be closed to recreational use. Inventoried OHV routes in the SEZ also would be closed. There could be some undetermined loss of recreational use in the Woolsey Peak and Signal Mountain WAs because of adverse effects on wilderness values. Potential impacts on recreational use in the Saddle Mountain SRMA are unknown.	None.
Military and Civilian Aviation	The military has expressed concern that any development in the SEZ that exceeds 250 ft (76 m) in height would interfere with military operations in the MTR that is above the SEZ. There would be no effect on civilian aviation facilities.	None. None.
Geologic Setting and Soil Resources	Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase. Impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. These impacts may be impacting factors for other resources (e.g., air quality, water quality, and vegetation).	None.
Minerals (fluids, solids, and geothermal resources)	None.	None.
Water Resources	Ground-disturbance activities (affecting 80% of the total area in the peak construction year) could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills. Construction activities may require up to 1,287 ac-ft (1.6 million m ³) of water during the peak construction year.	Wet-cooling options would not be feasible if groundwater were the chosen water source for a solar project; other technologies should incorporate water conservation measures.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Water Resources (Cont.)	Construction activities would generate as high as 74 ac-ft (91,000 m ³) of sanitary wastewater.	During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain.
		Before drilling a new well, permits must be obtained from the ADWR, and all groundwater rights policies of the ADWR must be followed.
		Groundwater monitoring and production wells should be constructed in accordance with state standards.
		Stormwater management plans and BMPs should comply with standards developed by the ADEQ.
	Assuming full development of the SEZ, operations would use the following amounts of water:	Water for potable uses would have to meet or be treated to meet drinking water quality standards.
	<ul style="list-style-type: none"> For parabolic trough facilities (419-MW capacity), 299 to 634 ac-ft/yr (369,000 to 782,000 million m³/yr) for dry-cooled systems; 2,101 to 6,289 ac-ft/yr (2.6 million to 7.8 million m³/yr) for wet-cooled systems. 	Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site and downstream in Centennial Wash.
	<ul style="list-style-type: none"> For power tower facilities (233-MW capacity), 166 to 352 ac-ft/yr (205,000 to 434,000 m³/yr) for dry-cooled systems; 1,166 to 3,493 ac-ft/yr (1.4 million to 4.3 million m³/yr) for wet-cooled systems. 	
	<ul style="list-style-type: none"> For dish engine facilities (233-MW capacity), 116 ac-ft/yr (143,000 m³/yr). 	

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Water Resources (Cont.)	<ul style="list-style-type: none"> For PV facilities (233-MW capacity), 12 ac-ft/yr (14,800 m³/yr). Assuming full development of the SEZ, operations would generate up to 6 ac-ft/yr (7,400 m³/yr) of sanitary wastewater. 	
Vegetation ^b	<p>Up to 80% (2,094 acres [8.5 km²]) of the SEZ would be cleared of vegetation; re-establishment of shrub communities in disturbed areas would likely be very difficult because of the arid conditions.</p> <p>Noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation.</p> <p>The deposition of fugitive dust from large areas of disturbed soil onto habitats outside a solar project area could result in reduced productivity or changes in plant community composition.</p> <p>Grading could affect wetland, dry wash, dry wash woodland, mesquite bosque, riparian, and saguaro cactus communities within the SEZ, access road, and transmission line corridors. Alteration of surface drainage patterns or hydrology could adversely affect downstream communities.</p>	<p>An Integrated Vegetation Management Plan, addressing invasive species control, and an Ecological Resources Mitigation and Monitoring Plan, addressing habitat restoration, should be approved and implemented to increase the potential for successful restoration of Creosotebush–White Bursage Desert Scrub and Sonoran Paloverde–Mixed Cacti Desert Scrub communities, as well as other affected habitats, and minimize the potential for the spread of invasive species or noxious weeds, such as those occurring in Maricopa County, that could be introduced as a result of solar energy project activities (see Section 8.3.10.2.2). Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.</p> <p>All wetland, dry wash, dry wash woodland, mesquite bosque, riparian, and saguaro cactus communities within the SEZ or access road corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. Any cacti that cannot be avoided should be salvaged. A buffer area should be maintained around dry washes, dry wash woodland, mesquite bosque, wetland, and riparian habitats to reduce the potential for impacts.</p>

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Vegetation ^b (Cont.)		<p>Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, dry wash woodland, mesquite bosque, and riparian habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation.</p> <p>Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities or riparian habitats along the Gila or Hassayampa Rivers.</p>
Wildlife: Amphibians and Reptiles ^b	<p>Direct impacts on amphibians and reptiles from development on the SEZ would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region). With implementation of proposed design features, indirect impacts would be expected to be negligible.</p>	None.
Wildlife: Birds ^b	<p>Direct impacts on bird species would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region).</p> <p>Other impacts on birds could result from collision with vehicles and infrastructure (e.g., buildings and fences), surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. These indirect impacts are expected to be negligible with the implementation of design features.</p>	<p>The requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed.</p> <p>Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and the Arizona Game and Fish Department. A permit may be required under the Bald and Golden Eagle Protection Act.</p>

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Wildlife: Mammals ^b	<p>Direct impacts on big game, small game, furbearers, and small mammals from habitat disturbance and long-term habitat reduction/fragmentation would be small (loss of $\leq 1.0\%$ of potentially suitable habitats identified for the species in the SEZ region).</p> <p>In addition to habitat loss, other direct impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and harassment. These indirect impacts are expected to be negligible with the implementation of design features.</p>	The fencing around solar energy projects should not block the free movement of mammals, particularly big game species.
Aquatic Biota ^b	<p>There are no permanent water bodies, streams, or wetlands present within the area of direct effects of either the proposed Gillespie SEZ or the presumed new access road corridor. There are also no high quality perennial surface water features in the area of indirect effects. Intermittent and ephemeral streams are present in the area of indirect effects and ground disturbance within the SEZ or new access road could increase the transport of soil into aquatic habitat within the Gila River via water- and airborne pathways. The Gila River and the Centennial Wash may contain aquatic habitat and biota and the Gila River flows into perennial surface waters (Colorado River). There is the potential that groundwater withdrawals could reduce surface water levels in the Gila River. Water quality in aquatic habitats in the Gila River and Centennial Wash could be affected by the introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during ground construction activities associated with the presumed new access road.</p>	None.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Special Status Species	<p>Potentially suitable habitat for 29 special status species occurs in the affected area of the Gillespie SEZ. For all of these special status species, less than 1% of the potentially suitable habitat in the region occurs in the area of direct effects.</p> <p>There are nine groundwater dependent species that occur outside of the areas of direct and indirect effects. Potential impacts on these species could range from small to large depending on the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals.</p>	<p>Pre-disturbance surveys should be conducted within the area of direct effects to determine the presence and abundance of special status species. Disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible for some species, translocation of individuals from areas of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies.</p> <p>Consultation with the USFWS and AZGFD should be conducted to address the potential for impacts on the following species currently listed as threatened or endangered under the ESA: Sonoran bald eagle, southwestern willow flycatcher, and Yuma clapper rail. Consultation would identify an appropriate survey protocol, avoidance and minimization measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements (if necessary).</p>

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Special Status Species (Cont.)		<p data-bbox="1316 363 1892 646">Coordination with the USFWS and AZGFD should be conducted to address the potential for impacts on the following species that are candidates or under review for listing under the ESA: Sonoran desert tortoise, Tucson shovel-nosed snake, and western yellow-billed cuckoo. Coordination would identify an appropriate survey protocol, and mitigation, which may include avoidance, minimization, translocation, or compensation.</p> <p data-bbox="1316 683 1892 805">Avoiding or minimizing disturbance to desert riparian habitat within the assumed access road corridor could reduce or eliminate impacts on the 17 special status species.</p> <p data-bbox="1316 842 1892 964">Avoidance or minimization of groundwater withdrawals to serve solar energy development on the SEZ could reduce or eliminate impacts to nine special status species.</p> <p data-bbox="1316 1002 1881 1187">Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based on consultation with the USFWS and AZGFD.</p>

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Air Quality and Climate	<p><i>Construction:</i> Temporary exceedances of AAQS for 24-hour and annual PM₁₀ and PM_{2.5} concentration levels at the SEZ boundaries and in the immediate surrounding area. Higher concentrations would be limited to the immediate area surrounding the SEZ boundary and would decrease quickly with distance. Modeling indicates that emissions from construction activities are not anticipated to exceed Class I PSD PM₁₀ increments at the nearest federal Class I area (Superstition WA). In addition, construction emissions (primarily NO_x emissions) from the engine exhaust from heavy equipment and vehicles have some potential to affect AQRVs (e.g., visibility and acid deposition) at the nearest federal Class I area.</p> <p><i>Operations:</i> Positive impact due to avoided emission of air pollutants from combustion-related power generation: 0.59 to 1.1% of total emissions of SO₂, NO_x, Hg, and CO₂ from electric power systems in the state of Arizona avoided (up to 565 tons/yr SO₂, 870 tons/yr NO_x, 0.008 ton/yr Hg, and 624,000 tons/yr CO₂).</p>	None.
Visual Resources	<p>The SEZ is in an area of low scenic quality, with cultural disturbances already present. Residents, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads.</p> <p>Solar development could produce large visual impacts on the SEZ and surrounding lands within the SEZ viewshed due to major modification of the character of the existing landscape.</p> <p>The SEZ is located 3.5 mi (5.6 km) from the Signal Peak WA. Because of the open views of the SEZ and elevated viewpoints, strong visual contrasts could be observed by WA visitors.</p>	The development of power tower facilities should be prohibited within the SEZ.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Visual Resources <i>(Cont.)</i>	<p>The SEZ is located 2.1 mi (3.4 km) from the Woolsey Peak WA. Because of the open views of the SEZ and elevated viewpoints, strong visual contrasts could be observed by WA visitors.</p> <p>The SEZ is located 4.3 mi (6.9 km) from the Saddle Mountain SRMA. Because of the open views of the SEZ and elevated viewpoints, moderate to strong visual contrasts could be observed by SRMA visitors.</p> <p>Approximately 18 mi (29 km) of Agua Caliente Road (Agua Caliente Scenic Drive) is within the SEZ viewshed. Approximately 2.2 mi (3.5 km) of the road is within the SEZ. Weak to strong visual contrasts could be observed within and near the SEZ by travelers on the Agua Caliente Road.</p> <p>Approximately 10.8 mi (17.4 km) of the Salome Highway is within the SEZ viewshed. Moderate visual contrast would be expected for most viewpoints on the Salome Highway. Approximately 29 mi (47 km) of Old U.S. 80 is within the SEZ viewshed. Strong visual contrasts could be observed within and near the SEZ by travelers on Old U.S. 80.</p> <p>The communities of Arlington, Palo Verde, Buckeye, and Wintersburg are located within the viewshed of the SEZ, although slight variations in topography and vegetation provide some screening. Strong visual contrasts could be observed within Arlington. Weak visual contrasts could be observed within the other communities.</p>	

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Acoustic Environment	<p><i>Construction.</i> Estimated noise levels at the nearest residences (1.8 mi [2.9 km] from the southeastern SEZ boundary) would be about 35 dBA, which is below the typical daytime mean rural background level of 40 dBA. In addition, an estimated 41-dBA L_{dn} at these residences is well below the EPA guidance of 55 dBA L_{dn} for residential areas.</p> <p><i>Operations.</i> For operation of a parabolic trough or power tower facility located near the southeastern SEZ boundary, the predicted noise level would be about 39 dBA at the nearest residences, which is below the typical daytime mean rural background level of 40 dBA. If the operation were limited to daytime, 12 hours only, a noise level of about 41 dBA L_{dn} would be estimated for the nearest residences, which is well below the EPA guideline of 55 dBA L_{dn} for residential areas. However, in the case of 6-hour TES, the estimated nighttime noise level at the nearest residences would be 49 dBA, which is well above the typical nighttime mean rural background level of 30 dBA. However, the day-night average noise level is estimated to be about 51 dBA L_{dn}, which is below the EPA guideline of 55 dBA L_{dn} for residential areas.</p> <p>If 80% of the SEZ were developed with dish engine facilities, the estimated noise level at the nearest residences would be about 38 dBA, which is below the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 41 dBA L_{dn} at these residences would be well below the EPA guideline of 55 dBA L_{dn} for residential areas.</p>	<p>Noise levels from cooling systems equipped with TES should be managed so that levels at the nearest residences to the east of the SEZ are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers.</p> <p>Dish engine facilities within the Gillespie SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearest residences (i.e., the facilities should be located in the central or northwestern portion of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at the nearest residences.</p>
Paleontological Resources	<p>The potential for impacts on significant paleontological resources in the proposed SEZ is unknown. A more detailed investigation of the alluvial deposits is needed prior to project approval. A paleontological survey will likely be needed</p>	<p>The need for and the nature of any SEZ-specific design features would depend on the results of future paleontological investigations.</p>

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Cultural Resources	<p>Direct impacts on significant cultural resources could occur in the proposed Gillespie SEZ; however, further investigation is needed. A cultural resources survey of the entire area of potential effects of any project proposed would first need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would need to follow to determine whether any are eligible for listing in the NRHP.</p> <p>Impacts on cultural resources also are possible in areas related to the access road, as areas of potential cultural significance could be directly affected by construction or opened to increased access from use.</p>	<p>SEZ-specific design features would be determined during consultations with the Arizona SHPO and affected Tribes and would depend on the findings of cultural surveys.</p>
Native American Concerns	<p>The proposed SEZ is adjacent to the Gila River corridor and lies along the traditional route linking the Colorado River and the Gila River. It is adjacent to the Gila Bend Mountains, which have been identified as culturally important. Development within the SEZ may result in visual or audible disturbance to sacred areas in the mountains. The SEZ itself does contain plant and traditionally important animal species. Development in the proposed SEZ would eliminate some traditionally important plants and some habitat of traditionally important animals. The importance of these resources relative to the plants and animal habitat that will remain undisturbed outside the SEZ must be determined in consultation with the affected Native American Tribe(s). Only 16 mi (26 km) north and upstream of the San Lucy District of the Tohono O’odham Reservation; extreme water drawdown in the SEZ could affect water supplies on the reservation.</p>	<p>The need for and nature of SEZ-specific design features would be determined during government-to-government consultation with the affected Tribes.</p>

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Socioeconomics	<p><i>Livestock grazing:</i> Construction and operation of solar facilities could decrease the amount of land available for livestock grazing in the SEZ, resulting in the loss of less than 1 job (total) and less than \$0.1 million (total) in income in the ROI.</p> <p><i>Construction:</i> 288 to 3,813 total jobs; \$17.8 million to \$236 million income in ROI for construction of solar facilities in the SEZ.</p> <p><i>Operations:</i> 6 to 150 annual total jobs; \$0.2 million to \$5.9 million annual income in the ROI.</p> <p>Construction of new access road: 244 jobs; \$9.4 million in income.</p>	None.
Environmental Justice	Although impacts are likely to be small, minority populations, as defined by CEQ guidelines, occur within 50 mi (80 km) of the boundary of the SEZ; this means that any adverse impacts of solar projects could disproportionately affect minority populations.	None.
Transportation	The primary transportation impacts are anticipated to be from commuting worker traffic. Single projects could involve up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). This additional volume of traffic on Old U.S. 80 would represent an increase in traffic of about 200% in the area of the Gillespie SEZ for a single project.	None.

Footnotes on next page.

TABLE 8.3.1.3-1 (Cont.)

Abbreviations: AAQS = ambient air quality standards; ADEQ = Arizona Department of Environmental Quality; ANHP = Arizona Natural Heritage Program; AQRV = air quality-related value; AZGFD = Arizona Game and Fish Department; BLM = Bureau of Land Management; BMP = best management practice; CEQ = Council on Environmental Quality; CO₂ = carbon dioxide; dBA = A-weighted decibel; DoD = U.S. Department of Defense; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; KOP = key observation point; L_{dn} = day-night average sound level; MTR = military training route; NO_x = nitrogen oxides; NP = National Park; NRHP = *National Register of Historic Places*; OHV = off-highway vehicle; PEIS = programmatic environmental impact statement; PM_{2.5} = particulate matter with an aerodynamic diameter of 2.5 μm or less; PM₁₀ = particulate matter with an aerodynamic diameter of 10 μm or less; PSD = prevention of significant deterioration; PV = photovoltaic; ROI = region of influence; ROW = right-of-way; SEZ = solar energy zone; SHPO = State Historic Preservation Office; SO₂ = sulfur dioxide; SRMA = Special Recreation Management Area; TES = thermal energy storage; USFWS = U.S. Fish and Wildlife Service; VRM = Visual Resource Management; WA = Wilderness Area.

- ^a The detailed programmatic design features for each resource area to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in the proposed Gillespie SEZ.
- ^b The scientific names of all plants, wildlife, aquatic biota, and special status species are provided in Sections 8.3.10 through 8.3.12.

1 **8.3.2 Lands and Realty**

2
3
4 **8.3.2.1 Affected Environment**

5
6 The proposed Gillespie SEZ, a relatively small and isolated SEZ, is about 17 mi (27 km)
7 southwest of Buckeye, Arizona. It is in the northeastern corner of a large block of undeveloped
8 BLM-administered land; it is bordered to the north and east by state and private lands. The Palo
9 Verde Nuclear Generating Station is located about 6 mi (10 km) north of the SEZ, and two large-
10 capacity transmission lines pass within 0.5 mi (0.8 km) of the SEZ near both the northern and
11 southern ends of the area. These transmission lines are located within designated local ROW
12 corridors, and portions of these local corridors also have been identified as 368(b) corridors. A
13 branch of the UP Railroad passes along the northwestern edge of the SEZ, also at a distance of
14 about 0.5 mi (0.8 km), and a small portion of the railroad ROW is within the boundaries of the
15 SEZ. Agua Caliente Road, a Maricopa County road, passes through the SEZ for about 4 mi
16 (6 km) and provides access to the SEZ and to public lands south and west of the SEZ. The
17 overall character of the land in the SEZ area is rural and undeveloped; it is used primarily for
18 grazing and some recreational activities. Portions of the SEZ, especially the southeastern third
19 of the area, are heavily dissected by small drainages.

20
21 As of February 2010, there was one ROW application for solar energy facility
22 development that overlaps a small portion of the SEZ, but the bulk of this application is for
23 public lands east of the SEZ. Several additional pending solar energy applications are for
24 areas within 20 mi (32 km) of the SEZ.

25
26
27 **8.3.2.2 Impacts**

28
29
30 **8.3.2.2.1 Construction and Operations**

31
32 Full development of the proposed Gillespie SEZ could disturb up to 2,618 acres (11 km²)
33 (Table 8.3.1.2-1). Development of the southeastern portion of the SEZ would require extensive
34 grading and development of drainage controls to make use of a relatively small area. The ROW
35 for the existing county road would be protected as a requirement of any solar development
36 proposal, but the road may prove to be an impediment to solar development since it meanders
37 throughout the larger northwestern portion of the SEZ. The ROW for the road occupies an
38 estimated 29 acres (0.1 km²) of the site. The road also cuts the SEZ area into smaller portions
39 and provides public access through the site. To avoid these issues, relocation of the road might
40 be considered as part of a site development plan.

41
42 The existing railroad ROW that is slightly overlapped by the SEZ appears to have been
43 granted by aliquot parts rather than on a survey that recorded the location of actual facilities, and
44 it likely does not contain any railroad-related facilities. It may be possible with the agreement of
45 the railroad to modify the ROW to allow for development of solar energy facilities in the overlap

1 area. It may also be easier to modify the boundary of the SEZ to conform to the existing
2 railroad ROW.

3
4 Full development of the SEZ for utility-scale solar energy production would establish an
5 isolated industrial area that would exclude many existing and potential uses of the land, perhaps
6 in perpetuity. Although a railroad, county road, and transmission lines are present near the
7 SEZ, the overall appearance of the SEZ is rural and undeveloped, and utility-scale solar energy
8 development would be a new and discordant land use in the area. An area 2 to 3 mi (3 to 5 km)
9 south of the SEZ is designated wilderness.

10
11 Should the proposed SEZ be identified as an SEZ in the ROD for this PEIS, the BLM
12 would still have discretion to authorize ROWs in the area until solar energy development was
13 authorized, and then future ROWs would be subject to the rights granted for solar energy
14 development. It is not anticipated that approval of solar energy development within the SEZ
15 would have a significant impact on the amount of public lands available for future ROWs near
16 the area.

17 18 19 **8.3.2.2.2 *Transmission Facilities and Other Off-Site Infrastructure Impacts***

20
21 Large transmission lines are located near the SEZ, and a minimal amount of land
22 disturbance would be required to construct a connection to one of these lines to allow for the
23 transmission of solar energy produced within the SEZ to the regional grid.

24
25 Old Highway 80 is the closest highway to the SEZ, and for analysis purposes it is
26 assumed that a new 3-mi (5-km) access road would be constructed to connect the southern end of
27 the SEZ to that highway. Creation of this access road would require surface disturbance of about
28 22 acres (0.1 km²) of public land. Alternative or additional access to the SEZ could be provided
29 via Agua Caliente Road, which passes through the SEZ. In such a case, improvement of the
30 existing road could be undertaken. Roads and transmission lines also would be constructed
31 within the SEZ as part of the development of the area.

32 33 34 **8.3.2.3 SEZ-Specific Design Features and Design Feature Effectiveness**

35
36 Implementing the programmatic design features described in Appendix A, Section A.2.2,
37 as required under BLM's Solar Energy Program would provide adequate mitigation for some
38 identified impacts.

39
40 Proposed design features specific to the proposed SEZ include the following:

- 41
42 • Priority consideration should be given to utilizing Agua Caliente Road to
43 provide construction and operational access to the SEZ.

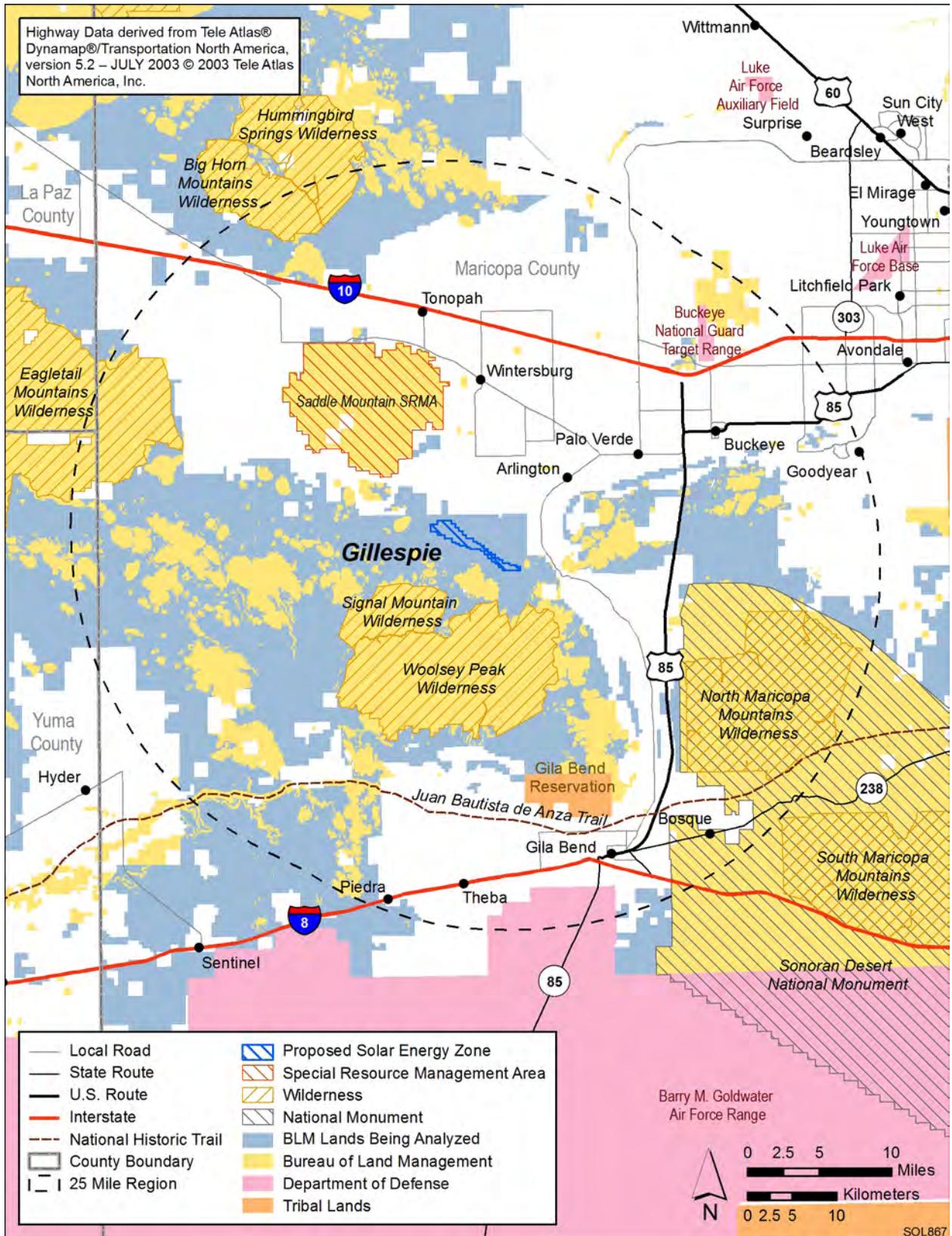
1 **8.3.3 Specially Designated Areas and Lands with Wilderness Characteristics**

2
3
4 **8.3.3.1 Affected Environment**

5
6 Ten specially designated areas are located within 25 mi (40 km) of the proposed
7 Gillespie SEZ that potentially could be affected by solar energy development within the SEZ
8 (Figure 8.3.3.1-1). Portions of three of these areas are within 5 mi (8 km) of the SEZ. The areas
9 include the following:

- 10
- 11 • National Monument
 - 12 – Sonoran Desert
 - 13
 - 14 • Wilderness Areas
 - 15 – Big Horn Mountains
 - 16 – Eagletail Mountains
 - 17 – Hummingbird Springs
 - 18 – North Maricopa Mountains
 - 19 – Signal Mountain
 - 20 – South Maricopa Mountains
 - 21 – Woolsey Peak
 - 22
 - 23 • National Historic Trail
 - 24 – Juan Bautista de Anza Trail
 - 25
 - 26 • Special Recreation Management Area
 - 27 – Saddle Mountain
 - 28

29 Viewshed analysis indicates that visitors traveling the route of the Juan Bautista de Anza
30 Trail might have limited visibility of development within the SEZ along about 5 mi (8 km) of the
31 trail route from a distance of about 20 mi (32 km). Because of topographic features between the
32 trail route and the SEZ, the only facilities that might be visible would be the tops of solar power
33 towers should that technology be employed. The South Maricopa Mountains WA has only a
34 miniscule percentage of its area within 25 mi (40 km) of the SEZ. Because of these factors, these
35 two specially designated areas are not considered further. There are no lands near the SEZ
36 outside of the 10 specially designated areas that have been identified as needing to be managed
37 to protect wilderness characteristics.
38



1

2 **FIGURE 8.3.3.1-1 Specially Designated Areas in the Vicinity of the Proposed Gillespie SEZ**

1 **8.3.3.2 Impacts**

2
3
4 **8.3.3.2.1 Construction and Operations**

5
6 The primary potential impact on the eight remaining specially designated areas near
7 the SEZ would be from visual impacts of solar energy development that could affect scenic,
8 recreational, or wilderness characteristics of the areas. The visual impact on specially designated
9 areas is difficult to determine and would vary by solar technology employed, the specific area
10 being affected, and the perception of individuals viewing the development. Development of the
11 SEZ, especially full development, would be an important visual component in the viewshed from
12 limited portions of some of these specially designated areas, as summarized in Table 8.3.3.2-1.
13 The data provided in the table, which show the potential area of impact, assumes the use of
14 power tower solar energy technology. Because of the potential height of some components, these
15 facilities, or portions of them, could be visible from the largest amount of land of any of the
16 technologies being considered in the PEIS. Viewshed analysis for this SEZ has shown that the
17 visual impacts of shorter solar energy facilities would be considerably less in some areas than
18 power tower technology (See Section 8.3.14 for more detail on all viewshed analyses discussed
19 in this section). Assessment of the visual impact of solar energy projects must be conducted on
20 a site-specific and technology-specific basis to accurately identify impacts.

21
22 In general, the closer a viewer is to solar development, the larger they perceive the
23 facility to be, and the greater the potential for adverse visual impacts. From a visual analysis
24 perspective, the most sensitive viewing distances generally are from 0 to 5 mi (0 to 8 km).

25
26 The viewing height above or below a solar energy development area, the size of the
27 solar development area, and the purpose for which a person is visiting an area are also important
28 factors in assessing potential impacts. Individuals seeking a wilderness or scenic experience in
29 areas within sight of solar energy facilities could be expected to be more adversely affected than
30 someone passing a solar facility while traveling along a highway with a destination in mind.
31 Because of the dramatically diminished visibility of solar energy structures at more than 25 mi
32 (40 km), the visual analysis is not extended beyond that point even though there are a few areas
33 where visibility of solar facilities still would be possible. In the case of the Gillespie SEZ, the
34 low-lying location of the SEZ in relation to portions of the Woolsey Peak and Signal
35 Mountain WAs and the Saddle Butte SRMA would tend to highlight the industrial-like
36 development in the SEZ.

37
38
39 **National Monument¹**

40
41 The northwestern portion of Sonoran Desert National Monument is about 11 mi (18 km)
42 from the SEZ and is at a slightly higher elevation. Solar development within the SEZ would be
43 visible from this portion of the National Monument between about 11 and 17 mi (18 and 27 km),

¹ This description applies only to the areas of the monument outside of the WAs. The WAs are discussed as separate units below.

TABLE 8.3.3.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40-km) Viewshed of the Proposed Gillespie SEZ, Assuming a Target Height of 650 ft (198.1 m)

Feature Type	Feature Name (Total Acreage/Linear Distance) ^b	Feature Area or Linear Distance ^a		
		Visible within 5 mi	Visible within 5 and 15 mi	Visible within 15 and 25 mi
National Monument	Sonoran Desert (496,513 acres)	0 acres	8,356 acres (1.7%) ^c	27,287 acres (5.5%)
National Historic Trail	Juan Bautista de Anza (1,210 mi)	0 mi	0 mi	22 mi (0.36%)
Wilderness Areas	Big Horn Mountains (20,954 acres)	0 acres	0 acres	2,303 acres (11%)
	Eagletail Mountains (98,544 acres)	0 acres	0 acres	11,918 acres (12%)
	Hummingbird Springs (31,429 acres)	0 acres	0 acres	4,501 acres (14%)
	North Maricopa Mountains (64,247 acres)	0 acres	1,331 acres (2%)	9,871 acres (15%)
	Signal Mountain (13,467 acres)	1,920 acres (14%)	2,514 acres (19%)	0 acres
	South Maricopa Mountains (60,466 acres)	0 acres	0 acres	3 acres (0.01%)
Special Recreation Management Area	Saddle Mountain (47,696 acres)	661 acres (1%)	27,223 acres (57%)	0 acres

^a To convert acres to km², multiply by 0.004047. To convert mi to km, multiply by 1.609.

^b Acres listed here are exclusive of the acreage included in the North and South Maricopa Mountains WAs.

^c Values in parentheses are percentage of feature acreage or road length viewable.

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but the viewing angle would be low, the view would be along the narrow axis of the SEZ, and the view would also include both highway and agricultural development between the Monument and the SEZ, leading to a conclusion that there would be minimal visual impact to this portion of the Monument. This northwestern portion of the Monument would have visibility of any type of solar development within the SEZ, not just power tower technology.

Traveling south along the western boundary of the Monument, the distance from the SEZ steadily increases and the views of solar development gradually become less distinct. In the area

1 of the Monument northeast of Gila Bend, the distances from the SEZ are between 15 and 25 mi
2 (24 and 40 km), and because of the distance and the low viewing angle, the visual impacts would
3 be expected to be minimal.

4
5 In summary, assuming the use of power tower solar technology, within 11 to 25 mi (17 to
6 40 km) of the SEZ, about 35,643 acres (144 km²), or 7.2%, of the Monument would have
7 potential views of solar development in the SEZ. These views would generally be low angle and
8 at relatively long distance, and are not expected to have a significant impact. If any of the lower-
9 height solar technologies are employed within the SEZ, views of the facilities from the
10 Monument would be restricted to only the northwestern corner of the area.

11 12 13 **Wilderness Areas**

14
15
16 ***Woolsey Peak and Signal Mountain.*** At their closest locations, these WAs are within
17 2 mi (3 km) and 3.5 mi (6 km), respectively, of the boundary of the proposed SEZ. At these close
18 distances and because of the elevated view of development in the SEZ from portions of these
19 WAs, it is anticipated that the wilderness characteristics on 5,552 acres (22 km²) of Woolsey
20 Peak and 1,920 acres (8 km²) of Signal Mountain would be adversely affected. An additional
21 5,837 acres (24 km²) of the Woolsey Peak WA with visibility of the SEZ is located at between
22 5 and 7 mi (8 and 11 km). Wilderness characteristics are also likely to be adversely affected in
23 these areas. Impacts within the Woolsey Peak unit would be restricted primarily to the
24 northeastern and west-central portions of the area. Within Signal Mountain WA, an additional
25 600 acres (2 km²) are located between 5 and 7 mi (8-11 km) of the SEZ, where wilderness
26 characteristics are also likely to be adversely affected. Most of the impact in the Signal Mountain
27 WA would occur on the northeastern portion of the area. The viewshed around these WAs is not
28 pristine, with the Agua Caliente Road, a railroad, transmission lines, and agricultural
29 development as close as 0.5 mi (0.8 km) from the border of the WAs. Based on additional
30 viewshed analysis, if any of the lower-height solar technologies were employed within the SEZ,
31 impacts on wilderness characteristics would be substantially reduced.

32
33
34 ***North Maricopa Mountains.*** This WA is located in the northern end of the Sonoran
35 Desert National Monument and at the closest is 13 mi (21 km) from the SEZ. Within 15 mi
36 (24 km) of the SEZ 1,331 acres (5.4 km²) of the wilderness is within the viewshed of the SEZ.
37 Much of the view of the SEZ is along its narrow axis, and the development would not take up
38 much of the field of view from the WA. It is not anticipated that wilderness characteristics within
39 this area would be adversely affected. Another 8,500 acres (34.4 km²) of area in the WA with
40 visibility of the SEZ is within the 15 to 25 mi (24 to 40 km) zone. Development in the SEZ
41 would be distantly visible, but at this distance, impact on wilderness characteristics would be
42 unlikely. Based on additional viewshed analysis, if any of the lower-height solar technologies
43 were employed, there would be substantially reduced visibility of solar facilities in the SEZ from
44 this WA.

1 *Eagletail Mountains, Bighorn Mountains, and Hummingbird Springs*. The nearest of
2 these WAs, the Eagletail Mountains WA, is 18 mi (29 km) from the northern boundary of the
3 SEZ. The other two WAs are about 21 mi (34 km) distant from the SEZ. The terrain between
4 these areas and the SEZ is relatively flat, and portions of each of these areas are in the viewshed
5 of the SEZ. However, because of the long distance from the SEZ, the low level of contrast that
6 would be associated with solar facilities, and the small portion of the field of view the SEZ
7 would occupy when viewed from these areas, it is not anticipated there would be any adverse
8 impact on wilderness characteristics in these WAs. Additionally, I-10, the Central Arizona
9 Project Canal, and a large amount of irrigated agricultural development are located in the near
10 foreground of all these areas, which would further reduce the visual effects of facilities in the
11 SEZ.

14 **Special Recreation Management Area**

16 The Saddle Mountain SRMA was established to emphasize provision of geologic,
17 cultural, and wildlife interpretive sites; protection of the area's scenic landscapes and vistas;
18 and promotion of recreation opportunities (BLM 2005). Portions of the SRMA within the
19 viewshed of the SEZ range from 4 to 13 mi (6 to 21 km) from the northern boundary of the SEZ
20 and about 57% of the area would have clear views into the SEZ. The SRMA is currently
21 surrounded by numerous types of human development including I-10, a railroad, the Palo Verde
22 Nuclear Generating Station, agricultural development, and residential development. Solar
23 development in the SEZ would contribute to a further reduction in the scenic viewshed of the
24 SRMA. Because the SEZ is so close to the SRMA and there is no topographic screening between
25 the SEZ and the SRMA, any of the technologies solar considered in this PEIS would be readily
26 visible to visitors within the SRMA.

29 **8.3.3.2.2 Transmission Facilities and Other Off-Site Infrastructure Impacts**

31 Large transmission lines are located near the SEZ, and only a minimal amount of land
32 disturbance would be required to connect to one of these lines and thus link the SEZ to the
33 regional grid. It is not anticipated that this connection would cause any additional impact to
34 specially designated areas.

36 Construction of a new 3-mi (5-km) long access road to Old Highway 80 would result in
37 the surface disturbance of about 22 acres (0.1 km²) of public land. Road construction would be
38 within the viewshed of the Woolsey Peak WA, and the road would come within 1.5 mi (2 km) of
39 the WA. The road would contribute additional adverse impacts on wilderness characteristics in
40 the area.

42 Roads and transmission lines also would be constructed within the SEZ as part of the
43 development of the area.

1 **8.3.3.3 SEZ-Specific Design Features and Design Feature Effectiveness**
2

3 Implementing the programmatic design features described in Appendix A, Section A.2.2,
4 as required under BLM’s Solar Energy Program would provide adequate mitigation for some
5 identified impacts.
6

7 The following is a proposed design feature specific to the proposed SEZ:
8

- 9 • Requiring that the solar technologies with lower profiles be used within the
10 SEZ would substantially reduce visual impacts on wilderness and scenic
11 resources.

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1 **8.3.4 Rangeland Resources**

2
3 Rangeland resources include livestock grazing and wild horses and burros, both of
4 which are managed by the BLM. These resources and possible impacts on them from solar
5 development within the proposed Gillespie SEZ are discussed in Sections 8.3.4.1 and 8.3.4.2.
6

7
8 **8.3.4.1 Livestock Grazing**

9
10
11 **8.3.4.1.1 Affected Environment**

12
13 The proposed Gillespie SEZ includes small portions of three ephemeral grazing
14 allotments (the A Lazy T, Jagow-Kreager, and Layton allotments) and one perennial allotment
15 (Gable-Ming). In the ephemeral allotments, grazing is authorized only in years with good winter-
16 spring rainfall when above-average amounts of annual forage are available. On the perennial
17 allotment, cattle are allowed to graze year-long. Table 8.3.4.1-1 summarizes key information
18 regarding these allotments.
19

20
21 **8.3.4.1.2 Impacts**

22
23 Should utility-scale solar development occur in the SEZ, grazing would be excluded
24 from the areas developed as provided for in the BLM grazing regulations (43 CFR Part 4100).
25
26

TABLE 8.3.4.1-1 Grazing Allotments within the Proposed Gillespie SEZ

Allotment	Total Acres ^a	% of Acres in SEZ ^b	Active BLM AUMs	No. of Permittees
A Lazy T	4,827	<1	NA ^c	1
Gable-Ming	121,421	1.3	4,200	1
Jagow-Kreager	13,175	<1	NA ^c	1
Layton	5,781	14.6	NA ^c	1

^a Includes only public land in the allotment based on the Allotment Master Reports included in the BLM's Rangeland Administration System (RAS) (BLM 2008c).

^b This is the percentage of the total acreage of public lands in the allotment located in the SEZ.

^c NA = Not applicable. Since these are ephemeral allotments, no active AUMs are recorded in the BLM RAS system.

1 This would include reimbursement of the permittees for their portion of the value for any range
2 improvements in the area removed from the grazing allotment. The impact of this change in
3 the grazing permits would depend on several factors, including (1) how much of an allotment
4 the permittee might lose to development, (2) how important the specific land lost is to the
5 permittee's overall operation, and (3) the amount of actual forage production that would be lost
6 by the permittee.
7

8 With the exception of the Layton allotment, the percentage of public land in the
9 allotments is so small that if it would be removed from the grazing there would be no significant
10 impact on livestock grazing. Since the Layton allotment is an ephemeral allotment, it is difficult
11 to estimate the potential loss of grazing use because ephemeral grazing operations are erratic.
12 They are dependent on yearly rainfall and the growth of annual forage. For this reason, no
13 estimate of potential loss is offered other than to make the assumption that future grazing
14 authorizations for the Layton allotment would be reduced by the same percentage as the
15 percentage reduction in public lands in the allotment, which would equate to a 14.6% reduction.
16
17

18 ***8.3.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness***

19
20 Implementing the programmatic design features described in Appendix A, Section A.2.2,
21 as required under BLM's Solar Energy Program would provide adequate mitigation for some
22 identified impacts.
23

24 The following is a proposed design feature specific to the proposed SEZ:

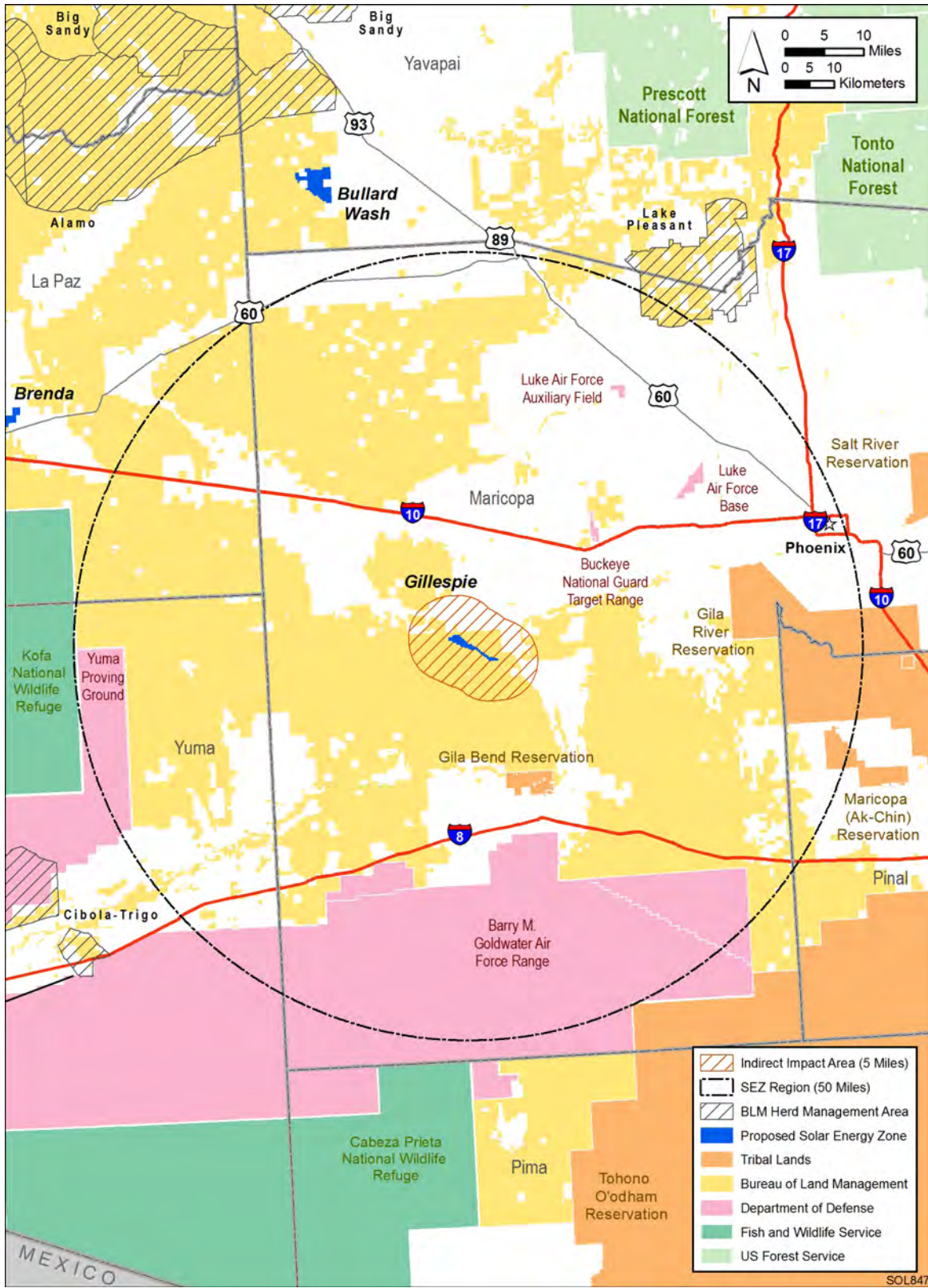
- 25
26 • Development of range improvements and changes in grazing management
27 should be considered to mitigate the loss of AUMs in the grazing allotment.
28
29

30 **8.3.4.2 Wild Horses and Burros**

31 32 ***8.3.4.2.1 Affected Environment***

33
34 Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur
35 within the six-state study area. Seven wild horse and burro herd management areas (HMAs)
36 occur within Arizona (BLM 2010d); a portion of only the Lake Pleasant HMA occurs within
37 50 mi (80 km) of the proposed Gillespie SEZ (Figure 8.3.4.2-1).
38
39

40 In addition to the HMAs managed by the BLM, the USFS has wild horse and burro
41 territories in Arizona, California, Nevada, New Mexico, and Utah, and is the lead management
42 agency that administers 37 of the territories (Giffen 2009; USFS 2007). None of the territories
43 occur within the SEZ region.
44



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FIGURE 8.3.4.2-1 Wild Horse and Burro Herd Management Areas within the Analysis Area for the Proposed Gillespie SEZ (Source: BLM 2010d)

1 **8.3.4.2.2 Impacts**

2
3 Because the proposed Gillespie SEZ is about 47 mi (76 km) or more from any wild horse
4 and burro HMAs managed by BLM and more than 50 mi (80 km) from any wild horse and burro
5 territories administered by the USFS, solar energy development within the SEZ would not
6 directly or indirectly affect wild horses and burros that are managed by these agencies.
7

8
9 **8.3.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness**

10
11 No SEZ-specific design features for solar development within the proposed Gillespie
12 SEZ would be necessary to protect or minimize impacts on wild horses and burros.

1 **8.3.5 Recreation**

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4 **8.3.5.1 Affected Environment**

5
6 The proposed Gillespie SEZ is about 7 mi (11 km) long and 1.4 mi (2 km) wide at its
7 widest point. Most of the area is less than 1 mi (2 km) wide. The axis of the area runs in a
8 northwest-southeast direction. The area is so narrow that little recreation use can take place other
9 than for passing through it on existing roads and trails to access other areas. The general area
10 around the SEZ and to the west is lightly used for recreation activities (Ragsdale 2010).
11

12 The Agua Caliente Road is a good-quality county road that provides access to old mines,
13 livestock facilities, and to the Signal Mountain and Woolsey Peak WAs, and BLM-administered
14 lands west and south of the SEZ (BLM undated). This road may be considered for designation as
15 a scenic road as part of the Sonoran Desert National Monument Management Plan and Phoenix
16 South RMP Amendment (BLM undated). The area within the SEZ is included within the
17 boundaries of the Lower Gila South RMP (BLM undated), and the area is designated as
18 “limited” to off highway and special recreation vehicle use. Travel is restricted to existing or
19 designated roads and vehicle routes. In addition to Agua Caliente Road, several inventoried
20 routes that cross the SEZ provide access to public lands, old mines, livestock facilities, and to
21 the Signal Mountain and Woolsey Peak WAs south of the SEZ (BLM undated).
22

23
24 **8.3.5.2 Impacts**

25
26
27 **8.3.5.2.1 Construction and Operations**

28
29 No significant loss of recreational use would be anticipated from development of the
30 proposed SEZ, although any current recreational users would lose the use of any portions of
31 the SEZ developed for solar energy production. Inventoried vehicle routes that pass through
32 areas developed for solar power production could be closed or rerouted, although the county-
33 maintained Agua Caliente Road would continue to provide general access through the area.
34

35 Woolsey Peak and Signal Mountain WAs are within 2 to 3.5 mi (3 to 6 km) of the SEZ,
36 and solar development within the SEZ would be very visible from areas within these WAs.
37 Saddle Mountain SRMA is within 4 mi (6 km), and most of the area would have clear views of
38 the SEZ. Whether the presence of solar development in the SEZ would affect recreational use of
39 these areas is unknown, but portions of these areas are located within the most sensitive visual
40 zone surrounding the proposed SEZ. It is anticipated that some users of portions of the WAs may
41 choose to move their activities farther away from solar energy facilities. Potential impacts on
42 visitor use in the SRMA are unknown.
43

44 Solar development within the SEZ would affect public access along OHV routes
45 designated open and available for public use. Data identifying open OHV routes within the
46 proposed SEZ were not available. If such routes were identified during project-specific analyses,

1 they would be re-designated as closed (see Section 5.5.1 for more details on how routes
2 coinciding with proposed solar facilities would be treated).

3
4
5 **8.3.5.2.2 Transmission Facilities and Other Off-Site Infrastructure**

6
7 No additional impacts on recreation use are anticipated from construction of transmission
8 facilities to provide a connection between the SEZ and the regional grid.

9
10 The new 3-mi (5-km) long road connecting the SEZ to Old Highway 80 would be visible
11 from Woolsey Peak and Signal Mountain WAs. Since the new road would come within 2 mi
12 (3 km) of the Woolsey Peak WA, the potential would exist for the road to contribute additional
13 adverse impact on wilderness characteristics and to cause a potential reduction in recreation use
14 within the WA. However, it is not anticipated that any additional impact caused by construction
15 of the road would be significant in either WA when compared to the adverse impact on the
16 wilderness characteristics already included in Section 8.3.3.2.1, above.

17
18
19 **8.3.5.3 SEZ-Specific Design Features and Design Feature Effectiveness**

20
21 Implementing the programmatic design features described in Appendix A, Section A.2.2,
22 as required under BLM’s Solar Energy Program would provide mitigation for some impacts on
23 recreation. No SEZ-specific design features for solar development within the proposed Gillespie
24 SEZ are recommended. However, adoption of the SEZ-specific design features suggested in
25 Section 8.3.3.3 to reduce impacts on wilderness characteristics may also reduce potential adverse
26 impacts on recreation use of the WAs.

1 **8.3.6 Military and Civilian Aviation**

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3
4 **8.3.6.1 Affected Environment**

5
6 The sky above the entire SEZ is encompassed by one MTR with a 300-ft (91-m) above-
7 ground-level operating floor that operates under visual flight rules. The SEZ is located 33 mi
8 (92 km) southwest of Luke Air Force Base and is located within an extensive web of MTRs
9 and SUAs.

10
11 The closest public airports to the SEZ are the Buckeye and Gila Bend Municipal
12 Airports, located 15 mi (42 km) northeast and 20 mi (32 km) south-southeast, respectively.
13 Neither of these airports has regularly scheduled passenger or freight service.

14
15
16 **8.3.6.2 Impacts**

17
18 The military has indicated that construction of solar or transmission facilities in excess of
19 250 ft (76 m) tall would adversely affect the use of the MTR.

20
21 Both of the civilian airports are far enough away from the SEZ to not be affected by
22 development on the site.

23
24
25 **8.3.6.3 SEZ-Specific Design Features and Design Feature Effectiveness**

26
27 No SEZ-specific design features for solar development within the proposed Gillespie
28 SEZ would be necessary to protect impacts on military and civilian aviation. Implementing the
29 programmatic design features described in Appendix A, Section A.2.2, as required under BLM's
30 Solar Energy Program, would provide adequate mitigation for military and civilian aviation.

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1 **8.3.7 Geologic Setting and Soil Resources**

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4 **8.3.7.1 Affected Environment**

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7 **8.3.7.1.1 Geologic Setting**

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9
10 **Regional Setting**

11
12 The proposed Gillespie SEZ is located within the Basin and Range physiographic
13 province in west-central Arizona. It lies to the southeast of the Harquahala Basin (Plain) and sits
14 on a dissected piedmont slope, between the Gila Bend Mountains to the southwest and
15 Centennial Wash, a dry ephemeral stream, to the northeast (Figure 8.3.7.1-1). Centennial Wash
16 flows to the southeast, joining the Gila River just north of the Gillespie Dam southeast of the site
17 (Figure 8.3.7.1-1).

18
19 Exposed sediments in the vicinity of the SEZ are predominantly older Quaternary
20 (10,000 to 750,000 yr) alluvial deposits (Qm) and sedimentary rocks of conglomerate and
21 sandstone of Tertiary age (Tsy). Younger alluvial deposits (<10,000 yr) are associated with
22 Centennial Wash. In the Gila Bend Mountains, exposures are predominantly composed of
23 Tertiary volcanics (andesite and basalts) and intrusives. The oldest rocks in the region are the
24 Early Proterozoic metamorphic and granitic rocks that occur in the Gila Bend Mountains to the
25 southwest of the SEZ and the Maricopa and Buckeye Mountains to the east.

26
27
28 **Topography**

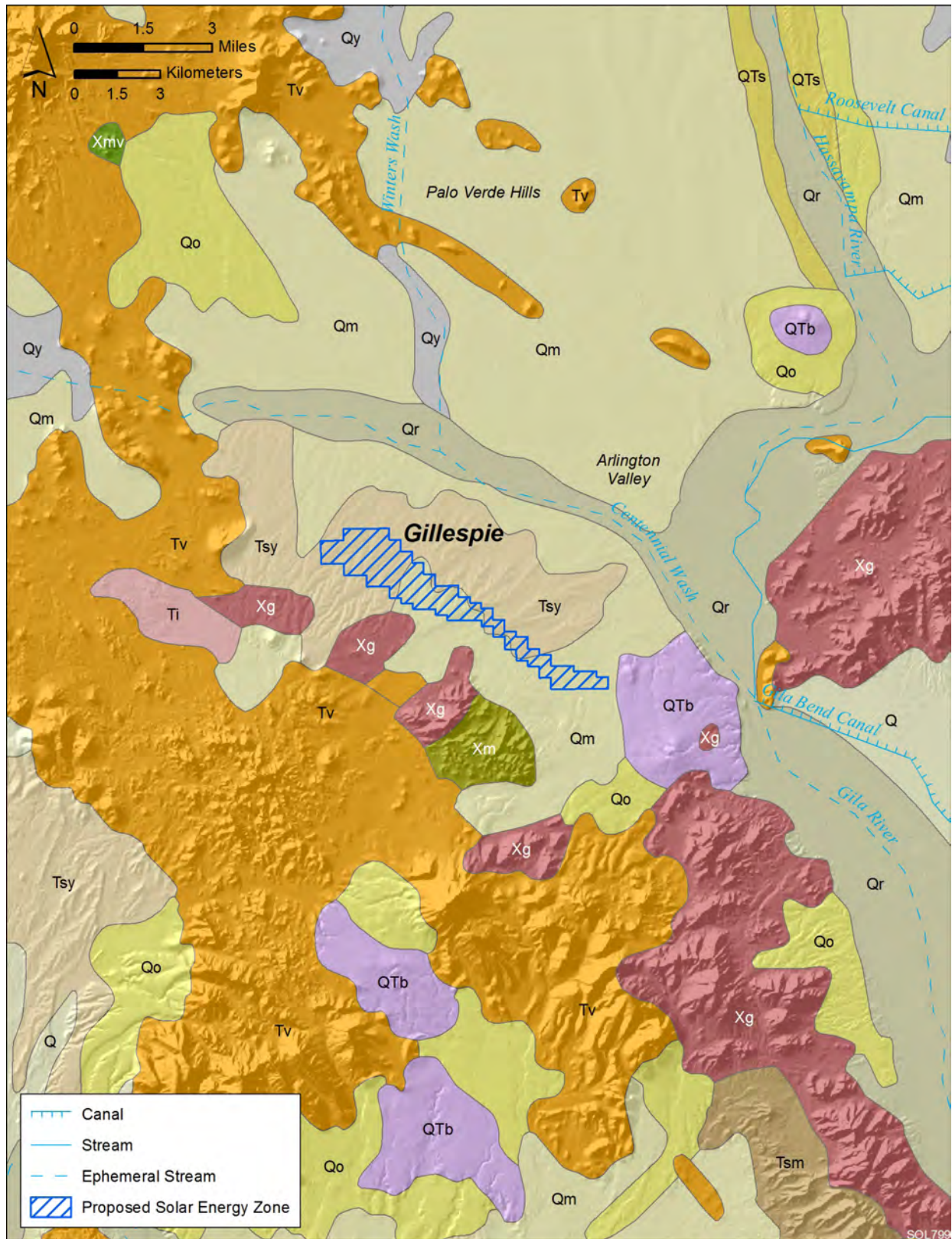
29
30 The proposed Gillespie SEZ is situated about 150 ft (45 m) above the Centennial Wash to
31 the northeast (Figure 8.3.7.1-1). The site terrain is fairly flat because the SEZ is narrow and
32 generally follows the slope contour. There is a slight slope to the northeast, with elevations in the
33 northwestern half of the SEZ ranging from about 950 ft (290 m) along the southwestern border to
34 920 ft (280 m) along the northeast-facing border, and elevations in the southeastern half ranging
35 from about 920 ft (280 m) to 880 ft (270 m). Several unnamed drainages enter the SEZ from the
36 southwest and drain to the northeast toward Centennial Wash (Figure 8.3.7.1-3).

37
38
39 **Geologic Hazards**

40
41 The types of geologic hazards that could potentially affect solar project sites and their
42 mitigation are discussed in Sections 5.7.3 and 5.7.4. The following sections provide a
43 preliminary assessment of these hazards at the proposed Gillespie SEZ. Solar project developers
44 may need to conduct a geotechnical investigation to assess geologic hazards locally to better
45 identify facility design criteria and site-specific design features to minimize their risk.



FIGURE 8.3.7.1-1 Physiographic Features of the Centennial Wash Valley near the Gila Bend Mountains



1

2 **FIGURE 8.3.7.1-2 Geologic Map of the Centennial Wash Valley near the Gila Bend Mountains**
 3 (adapted from Ludington et al. 2007 and Richard et al. 2000)

Cenozoic (Quaternary, Tertiary)

- Qy Young alluvium in stream channels and on flood plains and playas (0 to 10,000 yr)
- Qr River deposits (alluvium)
- Q Surficial deposits, including wind-blown sand (0 to 2 m.y.)
- Qm Surficial deposits (10,000 to 750,000 yr)
- Qo Older surficial deposits (750,000 to 3 m.y.)
- QTb Basaltic rocks
- QTs Basin-fill deposits (Miocene to Pleistocene)
- Tsy Consolidated conglomerate and sandstone
- Tsm Sedimentary rocks
- Tv Volcanic rocks
- Ti Shallow intrusives

Precambrian

- Xg Granitic rocks (1,600 to 1,800 m.y.)
- Xmv Metavolcanic rocks
- Xm Metamorphic rocks (Yavapai Supergroup and Pinal Schist)

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2 **FIGURE 8.3.7.1-2 (Cont.)**

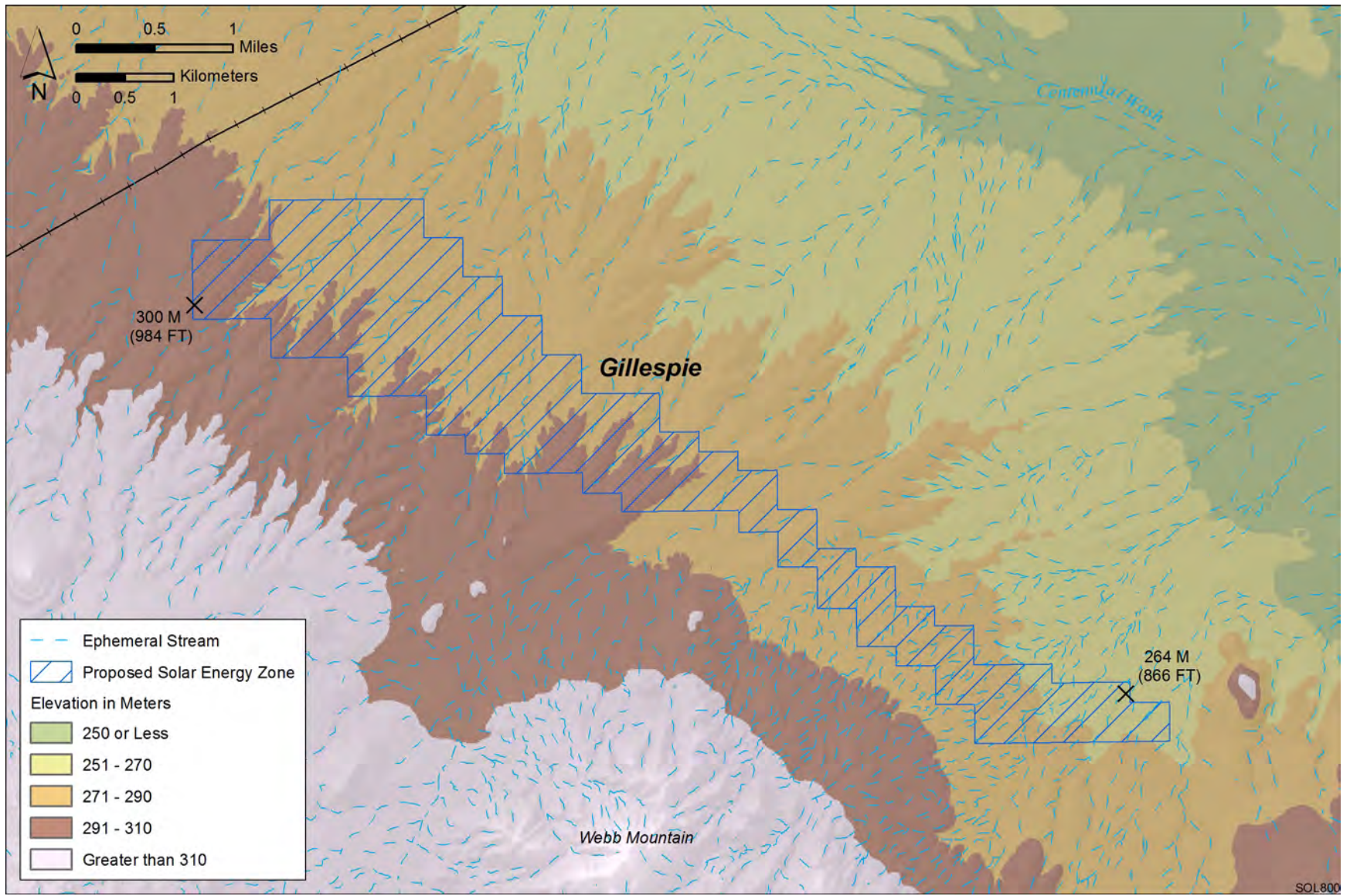


FIGURE 8.3.7.1-3 General Terrain of the Proposed Gillespie SEZ

1 **Seismicity.** Most of the seismic activity in Arizona occurs along the northwest-trending
2 boundary (transition zone) between the Basin and Range and Colorado Plateau physiographic
3 provinces north of the three proposed Arizona SEZs (Figure 8.3.7.1-4). No Quaternary faults
4 have been identified in the vicinity of the proposed Gillespie SEZ (USGS and AZGS 2010).
5

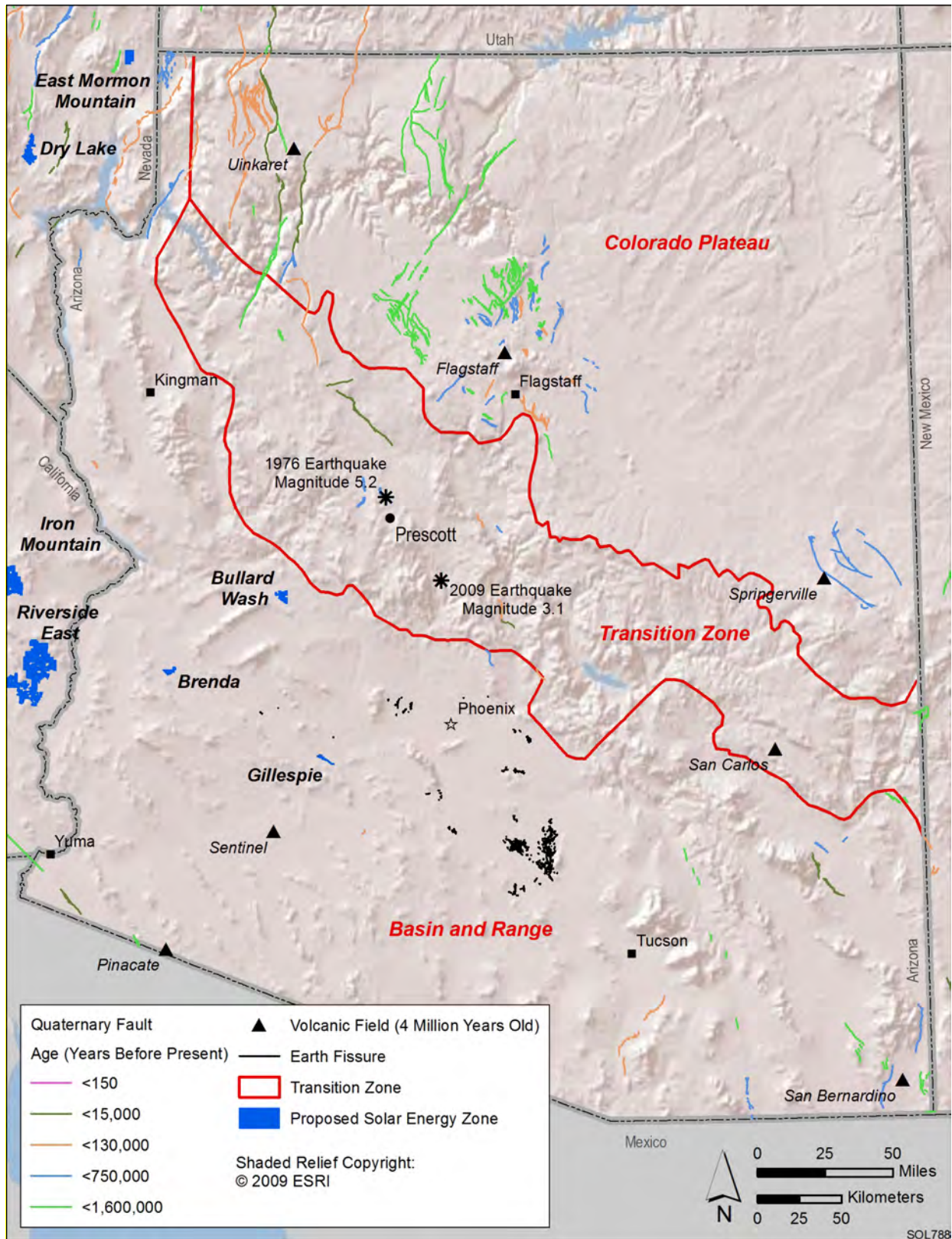
6 From June 1, 2000 to May 31, 2010, no earthquakes were recorded within a 61-mi
7 (100-km) radius of the proposed Gillespie SEZ (USGS 2010a). The most recent earthquakes
8 have occurred in northern Arizona (north of Flagstaff) and in southeastern California
9 (DuBois and Smith 1980). The largest earthquake in the region occurred on February 4, 1976,
10 near Prescott, Arizona, about 95 mi (155 km) north-northeast of the Gillespie SEZ
11 (Figure 8.3.7.1-4). The earthquake registered a magnitude² (ML) of 5.2 (USGS 2010a).
12
13

14 **Liquefaction.** The proposed Gillespie SEZ lies within an area where the peak horizontal
15 acceleration with a 10% probability of exceedance in 50 years is between 0.03 and 0.04 g.
16 Shaking associated with this level of acceleration is generally perceived as light to moderate; the
17 potential damage to structures is very light (USGS 2008). Given the low incidence of
18 earthquakes within a 61-mi (100-km) radius of the Gillespie SEZ and the very low intensity of
19 ground shaking estimated for the area, the potential for liquefaction in valley sediments is also
20 likely to be very low.
21
22

23 **Volcanic Hazards.** Extensive volcanic activity occurred in Arizona throughout the
24 Tertiary period; the most recent activity occurred less than 4 million years ago, mainly along
25 the edge of the Colorado Plateau in northeastern Arizona (Figure 8.3.7.1-4). Over the past
26 15 million years, eruptions were predominantly composed of basalt. The nearest volcanic center
27 is the Sentinel volcanic field, about 45 mi (70 km) due south of the proposed Gillespie SEZ;
28 basaltic lava flows erupted from volcanic vents in this area from about 3.3 to 1.3 million years
29 ago (Wood and Kienle 1992). Currently, there is no evidence of volcanic activity in Arizona
30 (Fellows 2000). Lynch (1982) suggests that the next eruption in Arizona would most likely occur
31 in the San Francisco Mountain, Uinkaret, or Pinacate volcanic fields and, because it likely would
32 be of the strombolian type (basaltic lava from a single vent with intermittent explosions), would
33 cause little damage or disruption.
34
35

36 **Slope Stability and Land Subsidence.** The incidence of rock falls and slope failures can
37 be moderate to high along mountain fronts and can present a hazard to facilities on the relatively
38 flat terrain of valley floors, if they are located at the base of steep slopes. The risk of rock falls
39 and slope failures decreases toward the flat valley center.
40

² Richter scale magnitude (ML) was the original magnitude defined by Richter and Gutenberg for local earthquakes in 1935. It was based on the maximum amplitude recorded on a Wood-Anderson torsion seismograph but is currently calculated for earthquakes with magnitudes ranging from 2 to 6, using modern instruments with adjustments (USGS 2010b).



1

2 **FIGURE 8.3.7.1-4 Quaternary Faults, Volcanic Fields, and Earth Fissures in Arizona (USGS and**

3 **AZGS 2010; USGS 2010a)**

1 The AZGS has reviewed aerial and satellite imagery and conducted on-the-ground
2 investigations at 23 study areas to identify and map earth fissures with surface expression. The
3 study areas are within four Arizona counties (Pinal, Maricopa, Cochise, and Pima) that are prone
4 to fissuring (Shipman and Diaz 2008). To date, earth fissures and subsidence of about 0.6 ft
5 (0.2 m) have been identified within the Harquahala Plain (Maricopa County), about 20 mi
6 (30 km) northwest of the proposed Gillespie SEZ (AZGS 2010; Galloway et al. 1999)
7 (Figure 8.3.7.1-4). The fissures are the result of ground subsidence due to groundwater
8 overdrafts in the basin that have caused differential compaction in the underlying aquifer.
9 Land failure caused by subsidence and fissures in parts of Arizona has been significant enough
10 to damage buildings, roads, railroads, and sewer lines and necessitate changes in the planned
11 route of the Central Arizona Project aqueduct (Galloway et al. 1999). Subsidence is also thought
12 to be occurring in McMullen Valley near Wendon, Arizona, and may account for frequent
13 flooding events on the Centennial Wash at that location (two 100-year floods in the last
14 10 years). Wendon is located on the Centennial Wash, upstream of the Gillespie SEZ, about
15 50 mi (85 km) to the northwest (Allison 2010).

16
17
18 **Other Hazards.** Other potential hazards at the proposed Gillespie SEZ include those
19 associated with soil compaction (restricted infiltration and increased runoff), expanding clay
20 soils (destabilization of structures), and hydro-compactable or collapsible soil (settlement).
21 Disturbance of soil crusts and desert pavement on soil surfaces may increase the likelihood
22 of soil erosion by wind.

23
24 Alluvial fan surfaces, such as those underlying the proposed SEZ, can be the sites of
25 damaging high-velocity “flash” floods and debris flows during periods of intense and prolonged
26 rainfall. The nature of the flooding and sedimentation processes (e.g., stream flow versus debris
27 flow fans) depends on the specific morphology of the fan (National Research Council 1996).
28 Section 8.3.9.1.1 provides further discussion of flood risks within the Gillespie SEZ.

31 **8.3.7.1.2 Soil Resources**

32
33 Soils within the proposed Gillespie SEZ are extremely gravelly sandy loams and very
34 gravelly sandy loams typical of alluvial fan (and fan terrace) settings (Figure 8.3.7.1-5). Parent
35 material consists of fan alluvium from mixed sources. Most soils are characterized as very deep
36 and somewhat excessively to excessively drained with moderate surface runoff potential and
37 moderate to very rapid permeability. The natural soil surface is moderately suited for roads, with
38 a slight to moderate water erosion hazard when used as roads or trails. The susceptibility to wind
39 erosion is low, although all soils have features favorable for dust formation if disturbed
40 (NRCS 2010).

41
42 None of the soils within the SEZ is rated as hydric.³ Occasional flooding of the Carrizo-
43 Momoli complex (flood plain) soils occurs along the major washes that cross the SEZ from the
44 southwest with a 5 to 50% chance of flooding in any given year. The flooding probability

³ A hydric soil is a soil formed under conditions of saturation, flooding, or ponding (NRCS 2010).

TABLE 8.3.7.1-1 Summary of Soil Map Units within the Proposed Gillespie SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential ^a	Wind Erosion Potential	Description	Area, in Acres ^b (% of SEZ)
37	Gunsight-Rillito-Carrizo complex (1 to 15% slopes)	Slight	Low (WEG 8) ^c	Consists of 45% Gunsight extremely gravelly sandy loam, 35% Rillito very gravelly sandy loam, and 15% Carrizo extremely gravelly sandy loam. Nearly level to sloping soils on alluvial fan terraces and flood plains. Parent material is alluvium from mixed sources. Soils are very deep and somewhat excessively drained, with moderate surface runoff potential and moderate to very rapid permeability. Available water capacity is very low to low. Slight rutting hazard. Used for rangeland and wildlife habitat; not suitable for cultivation.	2,370 (91)
34	Gunsight-Chuckawalla complex (1 to 15% slopes)	Slight	Low (WEG 8)	Consists of 40% Gunsight extremely gravelly sandy loam and 35% Chuckawalla extremely gravelly loam. Nearly level to sloping soils on alluvial fan terraces. Parent material is alluvium derived from mixed sources. Soils are very deep and somewhat excessively drained, with moderate surface runoff potential and moderate to moderately rapid permeability. Available water capacity is very low to low. Slight rutting hazard. Used for rangeland and wildlife habitat; not suitable for cultivation.	131 (5)
6	Carrizo-Momoli complex (0 to 3% slopes)	Slight	Low (WEG 8)	Consists of 65% Carrizo extremely gravelly sandy loam and 25% of Momoli very gravelly sandy loam. Level to gently sloping soils on alluvial fans, fan terraces, and flood plains. Parent material is alluvium from mixed sources. Soils are very deep and excessively drained, with low surface runoff potential (high infiltration rate) and moderately rapid to very rapid permeability. Available water capacity is very low to low. Slight rutting hazard. Used for rangeland and wildlife habitat; not suitable for cultivation.	117 (4)

Footnotes on next page.

1
2

TABLE 8.3.7.1-1 (Cont.)

- a Water erosion potential rates the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K (whole soil; doesn't account for the presence of rock fragments) and represent soil loss caused by sheet or rill erosion where 50 to 75% of the surface has been exposed by ground disturbance. A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions. A rating of "severe" indicates that erosion is expected; loss of soil productivity and damage are likely and erosion control measures may be costly or impractical.
- b To convert acres to km², multiply by 0.004047.
- c WEG = wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and take into account soil moisture, surface cover, soil surface roughness, wind velocity and direction, and the length of unsheltered distance (USDA 2004). Groups range in value from 1 (most susceptible to wind erosion) to 8 (least susceptible to wind erosion). The NRCS provides a wind erodibility index, expressed as an erosion rate in tons per acre per year, for each of the wind erodibility groups: WEGs 8,0 tons per acre per year.

Source: NRCS (2010).

1
2
3 decreases away from the washes where the frequency of flooding is less than once in 500 years.
4 Most of the soils are not suitable for cultivation unless irrigated; none are classified as prime
5 farmland. The major crops in the region are alfalfa (forage), cotton, and small grains with some
6 citrus (NRCS 2010; USDA 2010a).
7
8

9 **8.3.7.2 Impacts**

10
11 Impacts on soil resources would occur mainly as a result of ground-disturbing activities
12 (e.g., grading, excavating, and drilling), especially during the construction phase of a solar
13 project. These include soil compaction, soil horizon mixing, soil erosion and deposition by wind,
14 soil erosion by water and surface runoff, sedimentation, and soil contamination. Such impacts are
15 common to all utility-scale solar energy developments in varying degrees and are described in
16 more detail for the four phases of development in Section 5.7.1.
17

18 Because impacts on soil resources result from ground-disturbing activities in the project
19 area, soil impacts would be roughly proportional to the size of a given solar facility, with larger
20 areas of disturbed soil having a greater potential for impacts than smaller areas (Section 5.7.2).
21 The magnitude of impacts would also depend on the types of components built for a given
22 facility since some components would involve greater disturbance and would take place over a
23 longer timeframe.
24
25

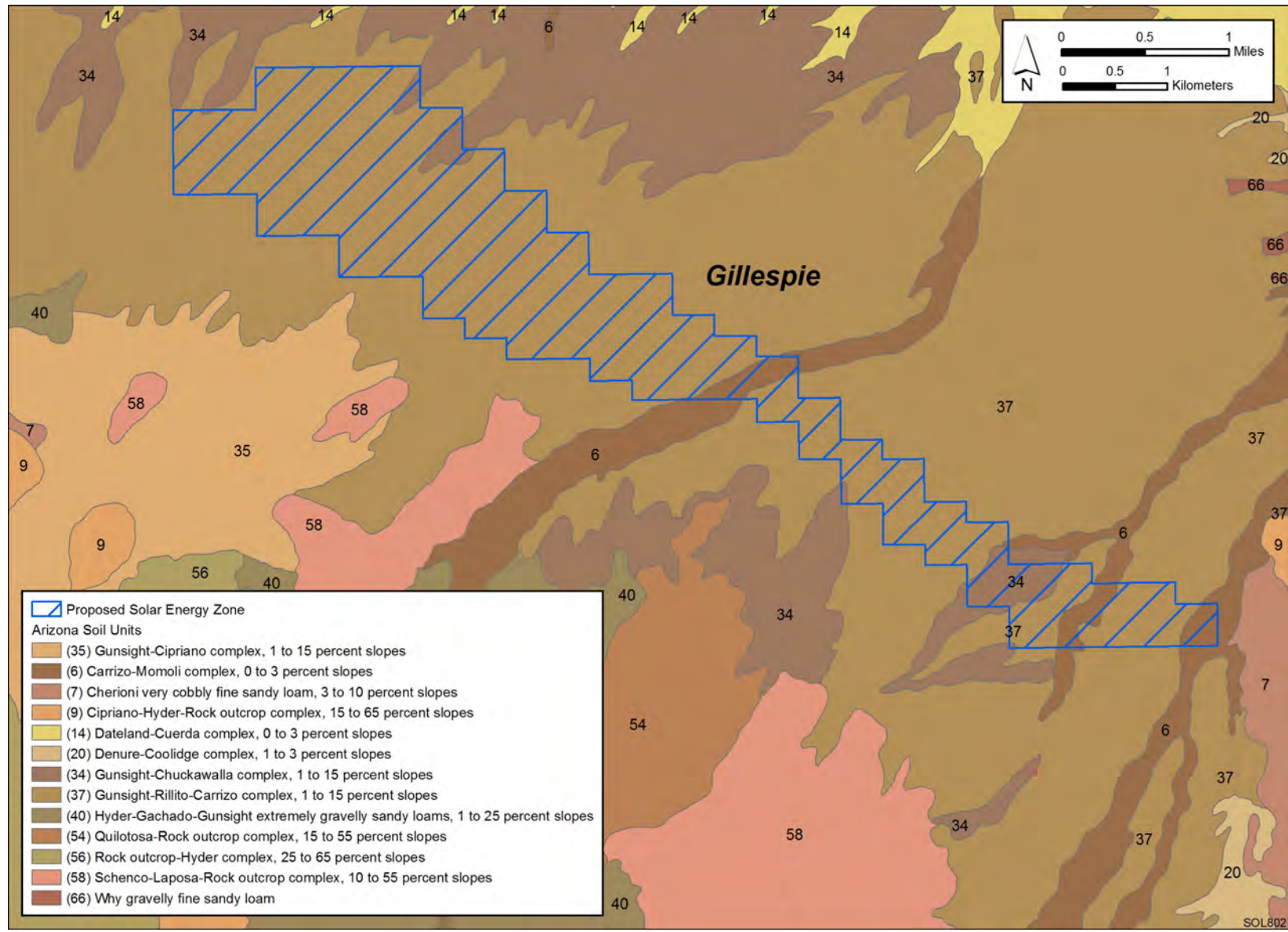


FIGURE 8.3.7.1-5 Soil Map for the Proposed Gillespie SEZ (NRCS 2008)

1 **8.3.7.3 SEZ-Specific Design Features and Design Feature Effectiveness**
2

3 No SEZ-specific design features were identified for soil resources at the proposed
4 Gillespie SEZ. Implementing the programmatic design features described under both Soils and
5 Air Quality in Appendix A, Section A.2.2, as required under BLM’s Solar Energy Program,
6 would reduce the potential for soil impacts during all project phases.
7

1 **8.3.8 Minerals (Fluids, Solids, and Geothermal Resources)**
2
3

4 **8.3.8.1 Affected Environment**
5

6 The public lands within the proposed Gillespie SEZ have been closed to locatable
7 mineral entry since June 2009 pending the outcome of this solar energy PEIS; however, as of
8 August 2, 2010, there are six placer mining claims that predate the mineral segregation and that
9 are located in the very northern portion of the SEZ (BLM and USFS 2010a). These claims
10 represent prior existing rights and they encumber all or portions of about 210 acres (0.8 km²)
11 within the SEZ.
12

13 No active oil and gas leases are within the SEZ. A portion of the northwestern corner of
14 the SEZ was leased in the past, but that lease has expired. Other scattered expired oil and gas
15 leases also are located in the area around the SEZ (BLM and USFS 2010b). The area remains
16 open for discretionary mineral leasing for oil and gas and other leasable minerals, and for
17 disposal of salable minerals.
18

19 No active geothermal leasing or development is occurring in or near the SEZ, nor has the
20 area been leased previously (BLM and USFS 2010b).
21
22

23 **8.3.8.2 Impacts**
24

25 The existing mining claims represent prior existing rights to a small portion of the SEZ,
26 and no solar development would be possible within this area without the claimant's agreement
27 or unless the claims are ruled to be invalid. The mining claimants are free to develop their claims
28 subject to existing regulations, so there would be no loss of locatable mineral resources in this
29 area. Since the rest of the SEZ does not contain existing mining claims, it is assumed that there
30 would be no future loss of locatable mineral production from within the area.
31

32 For the purpose of this analysis, it is assumed that future development of oil and gas
33 resources within the SEZ, should any be found, would continue to be possible, since such
34 development could occur with directional drilling from outside the SEZ. The production of
35 common minerals, such as sand and gravel and mineral materials used for road construction or
36 other purposes, might take place in areas not directly developed for solar energy production.
37

38 The SEZ has had no history of development of geothermal resources, and for that reason
39 it is not anticipated that solar development would adversely affect development of geothermal
40 resources.
41
42
43

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8.3.8.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required to protect mineral resources. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM’s Solar Energy Program would provide adequate mitigation for impacts on mineral resources.

1 **8.3.9 Water Resources**

2
3
4 **8.3.9.1 Affected Environment**

5
6 The proposed Gillespie SEZ is located within the Agua Fria River–Lower Gila River
7 subbasin of the Lower Colorado hydrologic region (USGS 2010c) and the Basin and Range
8 physiographic province characterized by intermittent mountain ranges and desert valleys
9 (Robson and Banta 1995). The proposed SEZ has surface elevations ranging between 880 and
10 1,040 ft (270 and 320 m). The proposed Gillespie SEZ is located in a valley northeast of the
11 Gila Bend Mountains that is separated from the Tonopah Desert to the north by the Palo Verde
12 Hills and other small mountain ranges (Figure 8.3.9.1-1). Average annual precipitation is
13 estimated to be less than 8 in./yr (20 cm/yr) (ADWR 2010a). Evaporation is estimated to be
14 105 in./yr (267 cm/yr) (Cowherd et al. 1988).

15
16
17 **8.3.9.1.1 Surface Waters (Including Drainages, Floodplains, and Wetlands)**

18
19 There are no perennial surface water features on the proposed Gillespie SEZ. The Gila
20 River is located 3 mi (5 km) east of the eastern edge of the SEZ and is perennial in this area due
21 to waste water treatment effluent released upstream of the area (ADWR 2010a). Centennial
22 Wash flows northwest to southeast to the Gila River approximately 2 to 3 mi (3 to 5 km)
23 northeast of the SEZ (Figure 8.3.9.1-1). Several ephemeral wash tributaries to Centennial Wash
24 flow through the proposed Gillespie SEZ from the mountains to the southwest. Runoff has been
25 measured at two locations in the Centennial Wash near the SEZ (gauges 9517490 and 9517500).
26 Mean annual flow was measured to be 1,486 ac-ft/yr (1.8 million m³/yr) and 3,065 ac-ft/yr
27 (3.8 million m³/yr), and maximum annual flow, 5,652 ac-ft/yr (7.0 million m³/yr) and
28 9,192 ac-ft/yr (11 million m³/yr) at gauges 9517490 and 9517500, respectively (ADWR 2010a).
29 Peak streamflow in Centennial Wash has been measured at up to 9,200 ft³/s (260 m³/s) in gauge
30 9517490 in 1993 (USGS 2010d).

31
32 Flood hazards within the SEZ are estimated to be between the 100-yr and 500-yr
33 floodplains (Zone X500) (FEMA 2009). Flood warning stations (5075 and 5095) are located at
34 the base of Webb Mountain to the southwest (ADWR 2010a). These stations provide alerts of
35 potential flooding from the unnamed washes that flow out the mountains and through the
36 proposed Gillespie SEZ (ADWR 2010a). A riverine wetland is mapped by the NWI just inside
37 the southeast corner of the SEZ (USFWS 2009a). For further details on wetlands near the SEZ,
38 see Section 8.3.10.

39
40
41 **8.3.9.1.2 Groundwater**

42
43 The proposed Gillespie SEZ is located within the Lower Hassayampa groundwater basin.
44 Recharge in the basin occurs primarily along the Gila River, Hassayampa River, and Centennial
45 Wash, where the basin deposits consist of recently deposited alluvium (Anderson 1995). The
46 three basin fill deposits within the Lower Hassayampa Basin are the upper alluvium, which



FIGURE 8.3.9.1-1 Surface Water Features near the Proposed Gillespie SEZ

1 consists of coarse-grained recent alluvial deposits approximately 30 to 60 ft (9 to 18 m) thick;
2 the middle alluvium, which consists of fine grained materials approximately 230 to 300 ft
3 (70 to 91 m) thick; and the lower alluvium, which consists of coarse-grained materials and some
4 consolidated alluvial fan deposits approximately 100 to more than 1,000 ft (30 to 300 m) thick
5 (ADWR 1999). Depth to groundwater near the SEZ ranged from 34 to 227 ft (10 to 69 m) below
6 ground surface in 1981, when the most recent measurements were obtained (USGS 2010d; wells
7 31438112535301, 331456112460101, 33180112541601).

8
9 Pre-disturbance groundwater inflow was estimated to be 32,000 ac-ft/yr
10 (39 million m³/yr) within the Lower Hassayampa Basin (Freethy and Anderson 1986). Inflows
11 were estimated to originate mainly from underflow from adjacent basins, with a small percentage
12 of inflows as recharge, derived both from loss from streams and from infiltration of precipitation
13 and runoff (Freethy and Anderson 1986). Inflows from the adjacent West Salt River Valley
14 basin were estimated to be between 15,000 and 30,000 ac-ft/yr (18 million and
15 37 million m³/yr); inflows from the adjacent Hassayampa Plain basin to the north, 1,000 and
16 5,000 ac-ft/yr (1.2 million and 6.2 million m³/yr); and inflows from the Harquahala Basin to
17 west, less than 1,000 ac-ft/yr (1.2 million m³/yr) (Freethy and Anderson 1986). Outflows to the
18 Gila Bend Basin to the south were estimated to be between 1,000 and 5,000 ac-ft/yr (1.2 million
19 and 6.2 million m³/yr), primarily as surface water discharge in the Gila River (Anderson 1995;
20 Freethy and Anderson 1986).

21
22 Pumping groundwater for agricultural purposes in the Lower Hassayampa Basin
23 reportedly began in the early 1950s (ADWR 1999). Between the 1950s and 1998, water levels
24 declined by up to 90 ft (27.4 m) in the Lower Hassayampa Basin (ADWR 1999). In 1998, a
25 large cone of depression was present in the Lower Hassayampa Basin because of continued
26 agricultural pumping (ADWR 1999).

27
28 Groundwater withdrawals in the Lower Hassayampa Basin have led to land subsidence
29 within the basin and an earth fissure approximately 1,200 ft (366 m) long southeast of the town
30 of Wintersburg (ADWR 2010b; AZGS 2009). Land subsidence was measured to be occurring
31 at a rate of up to 0.8 in./yr (2 cm/yr) between 2006 and 2008, primarily in the agricultural areas
32 along the Gila River and near the town of Buckeye (ADWR 2010b).

33
34 TDS concentrations sampled from within the Lower Hassayampa Basin range from
35 1,200 mg/L to more than 3,000 mg/L, and thus the water within the basin exceeds the EPA
36 secondary MCL for TDS (ADWR 2010a; EPA 2009a; USGS 2010d). Drinking water standard
37 exceedances of fluoride, arsenic, nitrate, and volatile or semivolatile organic compounds have
38 also been found in the basin (ADWR 2010a; USGS 2010d, wells: 331519112484901,
39 331801112541601, 331829112495701, and 331845112522301).

40 41 42 **8.3.9.1.3 Water Use and Water Rights Management**

43
44 In 2005, water withdrawals from surface waters and groundwater in Maricopa County
45 were 1.58 million ac-ft/yr (1.95 billion m³/yr), of which 16% came from surface waters and
46 84% from groundwater. The largest water use category was agriculture, at 1.27 million ac-ft/yr

1 (1.57 billion m³/yr). Thermoelectric water uses accounted for 26,400 ac-ft/yr
2 (32.6 million m³/yr), with public supply, municipal, and industrial water uses on the order of
3 25,800 ac-ft/yr (31.8 million m³/yr), 7,800 ac-ft/yr (9.6 million m³/yr), and 6,200 ac-ft/yr
4 (7.6 million m³/yr), respectively (Kenny et al. 2009).

5
6 Arizona water law is based on the doctrine of prior appropriation. However, water laws in
7 Arizona are based on a bifurcated system in which surface water and groundwater rights are
8 administered and assessed separately. The state of Arizona has four main sources of water:
9 Colorado River water, surface water separate from the Colorado River, groundwater, and treated
10 effluent. Rights for these four sources are assessed and administered separately; Colorado River
11 water is regulated under the Law of the River, surface water is based on prior appropriation, and
12 groundwater rights are handled on a region by region basis (BLM 2001). Effluent is not available
13 for use until it takes on the characteristics of surface water through treatment (ADWR 2010d).
14 The ADWR is the agency responsible for the conservation and distribution of water in the state.
15 It is also responsible for the administering and assessment of novel and transfer of existing water
16 rights and applications. The agency's broad goal is the security of long-term dependable water
17 supplies for the state, which is the main factor in the assessment of water right applications
18 (ADWR 2010f).

19
20 Upon completion of an application for water rights, the ADWR assesses it with three
21 main criteria: whether the proposed water right will conflict with more senior water rights,
22 whether the proposed right is a threat to public safety, and whether the proposed right will be
23 detrimental to the interests and welfare of the general public (BLM 2001). Generally, surface
24 water rights are assessed solely upon the criteria above but they may also be subject to certain
25 management plans in specific areas put into effect by the ADWR. Unlike the majority of
26 groundwater rights that are bound to the land they occupy, users of surface water rights have the
27 option to change location of the water right but not the beneficial use (a change of beneficial use
28 application would need to be submitted). In order to change a surface water right's location, a
29 "sever and transfer" permit needs to be approved by the ADWR and the governing body of the
30 irrigation district or water users council of the proposed new location of the surface water right.
31 Evaluations of "sever and transfer" permits follow the same general evaluation guidelines as new
32 surface water rights, and the proposed new location of the right after the transfer is treated as a
33 new surface water right. The new surface water right must not exceed the old one in annual water
34 use (ADWR 2010d).

35
36 Arizona has rights to 2.8 million ac-ft (3.4 billion m³/yr) of Colorado River water
37 annually, which is further subdivided into allocations for both general Colorado River water
38 users and Central Arizona Project (CAP) users (ADWR 2010j). CAP is a system of water
39 delivery canals, aqueducts, and pumping stations that deliver 1.5 million ac-ft/yr
40 (1.9 billion m³/yr) of Colorado River water from Lake Havasu to Pima, Pinal, and Maricopa
41 Counties annually (CAP 2010). The flows of the Colorado River are variable and thus the water
42 resource availability is variable from year to year.

43
44 Due to historic groundwater overdraft, where groundwater recharge is exceeded by
45 discharge (in some places groundwater overdraft is in excess of 700,000 ac-ft/yr
46 [863 million m³/yr]), the Ground Water Management Code (The Code) was put into effect in

1 1980 (ADWR 2010j; ADWR 1999). The Code describes three main goals for the state regarding
2 the management of groundwater: controlling severe overdraft, the allocation of the limited water
3 resources of the state, and the enhancement of the state’s groundwater resources using water
4 supply development (BLM 2001). Arizona’s groundwater management laws are separated using
5 a three-tier system based on the Code, in which proposed applications are evaluated with an
6 increasing level of scrutiny. The lowest level of management includes provisions that apply
7 statewide, Irrigation Non-Expansion Areas (INAs) have an intermediate level of management,
8 and Active Management Areas (AMAs) have the highest level of management with the most
9 restrictions and provisions. Within an AMA or INA, a groundwater permit is required
10 (BLM 2001). There are currently five AMAs and three INAs in the state, which each have their
11 own specific rules and regulations regarding the appropriation of groundwater (ADWR 2010i).
12 In locations outside of designated AMAs and INAs, a permit is not necessary to withdraw
13 groundwater (BLM 2001). Use of this groundwater, however, requires the filing of a notice of
14 intent to drill with the ADWR.

15
16 Recently, the ADWR (2010d) has created guidelines regarding the appropriation of water
17 for solar generating facilities, specifically detailing what information needs to be submitted for
18 permit evaluation. Required information includes the proposed method of power generation, the
19 proposed amount of water to be consumed, the point of diversion, and to what or whom the
20 power is to be distributed. To secure water rights for a solar facility to be located within an
21 AMA, the applicant must demonstrate that there is an “assured water supply” for the life of the
22 project. The ADWR then makes a decision based on whether the proposed water right will be
23 detrimental to public welfare and general conservation of water (ADWR 2010d).

24
25 The Arizona State Legislature created the Underground Water Storage and Recovery
26 Program in 1986 and enacted the Underground Water Storage, Savings, and Replenishment Act
27 in 1994 to make use of excess water that may be lost in times of surplus water supply (AWBA
28 2010). The Underground Water Storage, Savings, and Replenishment Act created the Arizona
29 Water Banking Authority, which has two programs: (1) Underground Storage Facilities, which
30 use excess CAP water, other surface water, or effluent to artificially recharge a groundwater
31 aquifer, and (2) Groundwater Savings Facilities, which provide water supplies (CAP water, other
32 surface water or effluent) in lieu of using groundwater, allowing the groundwater to stay in
33 storage and become “savings” (ADWR 2010e; AWBA 2010). The ADWR is in charge of the
34 distribution of the program’s waters as well as the evaluations of permits to store and recover
35 their waters (ADWR 2010e). In order to put this water to use, the ADWR must first award a
36 recovery well permit (ADWR 2010e). If a recovery well permit is submitted for use inside an
37 AMA, a “hydrologic impact analysis” report may also need to be submitted (ADWR 2010d).

38
39 From a groundwater management perspective, the proposed Gillespie SEZ is located
40 within the Hassayampa subbasin of the Phoenix AMA basin (ADWR 1999). The Phoenix
41 AMA is subdivided into five groundwater subbasins. The Hassayampa is further divided into
42 the Northern Hassayampa Plain and the Lower Hassayampa Basin (ADWR 1999), the latter
43 of which has boundaries very similar to those of the Lower Hassayampa Basin, as described in
44 USGS reports (e.g., Anderson 1995; Freethy and Anderson 1986). The Phoenix AMA is the
45 largest AMA with an area of 3.6 million acres (14,600 km²) and an estimated annual natural
46 recharge of 24,200 ac-ft (29.8 million m³) (ADWR 2010a). Between 2001 and 2005 there was

1 an annual groundwater use of 814,300 ac-ft (1.0 billion m³) and an annual surface water use of
2 1.44 million ac-ft (1.8 billion m³) within the Phoenix AMA (ADWR 2010a).

3
4 Groundwater management and assessment of groundwater applications for rights inside
5 AMAs are coordinated by a Ground Water Users Advisory Council (GUAC), a governor-
6 appointed council responsible for managing groundwater within each AMA (BLM 2001). The
7 goal of each GUAC is to achieve “safe yield” in the basin, a scenario in which total inflow of
8 water into the basin is equal to outflow (BLM 2001). In order to achieve these goals, updated
9 groundwater basin management plans are drafted every 10 yr, with conservation plans and
10 requirements becoming more stringent with time. Management plans have been and will be
11 drafted from 1980 to 2025, with the last period being only 5 yr, for a total of five management
12 plans. Each AMA is currently in the third period of the plan management cycle, from 2000 to
13 2010 (ADWR 2010c).

14
15 Groundwater banking provides water within the Phoenix AMA. Within the Phoenix
16 AMA the total permitted storage capacity for underground storage facilities is 962,000 ac-ft/yr
17 (1.19 billion m³/yr) and the total permitted storage capacity for groundwater storage facilities is
18 517,520 ac-ft/yr (638 million m³/yr) (ADWR 2010a). Total deliveries of water to the Phoenix
19 AMA through the AWBA were 79,800 ac-ft (98.5 million m³) in 2008, 150,200 ac-ft
20 (185 million m³) in 2007, 124,600 ac-ft (154 million m³) in 2006, and 33,100 ac-ft
21 (40.8 million m³) in 2005 (ABWA 2010).

22
23 Because the proposed Gillespie SEZ is within an AMA, more restrictions on water use
24 will apply. Water conservation requirements are also more stringent with AMAs.

25
26 Effluent may also be available for use by proposed solar facilities. The Palo Verde
27 Nuclear Plant, which is also within the Lower Hassayampa Basin, has secured effluent of up
28 to 80,000 ac-ft/yr (98.7 million m³/yr) through 2050 from Phoenix (Bui 2010). More than
29 324,000 ac-ft/yr (400 million m³/yr) of effluent is produced within the Phoenix AMA
30 (ADWR 2010a).

31 32 33 **8.3.9.2 Impacts**

34
35 Potential impacts on water resources related to utility-scale solar energy development
36 include direct and indirect impacts on surface waters and groundwater. Direct impacts occur at
37 the place of origin and at the time of the proposed activity, while indirect impacts occur away
38 from the place of origin or later in time. Impacts on water resources considered in this analysis
39 are the result of land disturbance activities (construction, final developed site plan, as well as
40 off-site activities such as road and transmission line construction) and water use requirements
41 for solar energy technologies that take place during the four project phases: site characterization,
42 construction, operations, and decommissioning/reclamation. Both land disturbance and
43 consumptive water use activities can affect groundwater and surface water flows, cause
44 drawdown of groundwater surface elevations, modify natural drainage pathways, obstruct natural
45 recharge zones, and alter surface water-wetland-groundwater connectivity. Water quality also

1 can be degraded through the generation of wastewater, chemical spills, increased erosion and
2 sedimentation, and increased salinity (e.g., by excessive withdrawal from aquifers).

3 4 5 **8.3.9.2.1 Land Disturbance Impacts on Water Resources**

6
7 Impacts related to land disturbance activities are common to all utility-scale solar energy
8 facilities, which are described in more detail for the four phases of development in Section 5.9.1;
9 these impacts will be minimized through the implementation of programmatic design features
10 described in Appendix A, Section A.2.2. Land disturbance impacts in the vicinity of the Gillespie
11 SEZ could potentially enhance erosion processes, disrupt groundwater recharge, and negatively
12 affect plant and animal habitats associated with the ephemeral channels. Tributaries to
13 Centennial Wash convey flows during storm events, as evident from channel incision and
14 sedimentation patterns within, upstream, and downstream of the Gillespie SEZ. Land disturbance
15 within the SEZ could potentially cause channel incision and sedimentation problems for the
16 Centennial Wash system.

17 18 19 **8.3.9.2.2 Water Use Requirements for Solar Energy Technologies**

20 21 22 **Analysis Assumptions**

23
24 A detailed description of the water use assumptions for the four utility-scale solar energy
25 technologies (parabolic trough, power tower, dish engine, and PV systems) is presented in
26 Appendix M. Assumptions regarding water use calculations specific to the proposed Gillespie
27 SEZ include the following:

- 28
29 • On the basis of a total area of 2,618 acres (10.6 km²), it is assumed that one
30 solar project would be constructed during the peak construction year;
- 31
32 • Water needed for making concrete would come from an off-site source;
- 33
34 • The maximum land disturbance for an individual solar facility during the peak
35 construction year would be 2,094 acres (12 km²);
- 36
37 • Assumptions on individual facility size and land requirements (Appendix M),
38 along with the assumed number of projects and maximum allowable land
39 disturbance, result in the potential to disturb up to 80% of the SEZ total area
40 during the peak construction year; and
- 41
42 • Water use requirements for hybrid-cooling systems are assumed to
43 be on the same order of magnitude as those using dry-cooling system
44 (see Section 5.9.2.1).
- 45
46

1 **Site Characterization**

2
3 During site characterization, water would be used mainly for fugitive dust control and the
4 workforce potable water supply. Impacts on water resources during this phase of development
5 are expected to be negligible, since activities would be limited in area, extent, and duration;
6 water needs could be met by trucking in water from an off-site source.
7

8
9 **Construction**

10
11 During construction, water would be used mainly for controlling fugitive dust and for
12 providing the workforce potable water supply. Because there are no significant surface water
13 bodies on or adjacent to the Gillespie SEZ, the water requirements for construction activities
14 could be met either by trucking water to the sites, using on-site groundwater resources, or piping
15 in surface water or effluent. Water requirements for dust suppression and potable water supply
16 during the peak construction year are shown in Table 8.3.9.2-1 and could be as high as
17 1,287 ac-ft (1.6 million m³/yr). The assumptions underlying these estimates for each solar energy
18 technology are described in Appendix M. Groundwater wells would have to yield up to an
19 estimated 800 gpm (3,000 L/min) to meet the estimated construction water requirements. This
20 yield is within the range of producing wells within the Lower Hassayampa Basin and is typical
21 of well yields of small to medium-sized farms in Arizona (ADWR 2010a; USDA 2009a).
22 Withdrawal of the construction water would require a permit from the ADWR. In addition to
23 groundwater withdrawal, up to 74 ac-ft (91,000 m³/yr) of sanitary wastewater would be
24 generated annually and need to be either treated on-site or sent to an off-site facility.
25 Groundwater quality in the vicinity of the SEZ has concentrations of TDS, arsenic, fluoride, and
26
27

TABLE 8.3.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Gillespie SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements ^a				
Fugitive dust control (ac-ft) ^{b,c}	1,199	1,255	1,255	1,255
Potable supply for workforce (ac-ft)	74	31	13	7
Total water use requirements (ac-ft)	1,273	1,287	1,268	1,262
Wastewater generated				
Sanitary wastewater (ac-ft)	74	31	13	7

^a Assumptions of water use for fugitive dust control, workforce potable supply, and wastewater generation are presented in Table M.9-1 (Appendix M).

^b Fugitive dust control estimation assumes a local pan evaporation rate of 105 in./yr (267 cm/yr) (Cowherd et al. 1988; WRCC 2010b).

^c To convert ac-ft to m³, multiply by 1,234.

1 other constituents that exceed drinking quality standards (ADWR 2010a). Water would need to
2 be treated or imported to meet drinking water quality standards for potable water.
3
4

5 **Operations**

6

7 Water would be required for mirror/panel washing, the workforce potable water supply,
8 and cooling during operations. Cooling water is required only for the parabolic trough and power
9 tower technologies. Water needs for cooling are a function of the type of cooling used (dry, wet,
10 hybrid). Further refinements to water requirements for cooling would result from the percentage
11 of time that the option was employed (30 to 60% range assumed) and the power of the system.
12 The differences between the water requirements reported in Table 8.3.9.2-2 for the parabolic
13 trough and power tower technologies are attributable to the assumptions of acreage per
14 megawatt. As a result, the water usage for the more energy-dense parabolic trough technology
15 is estimated to be almost twice as large as that for the power tower technology.
16

17 The water use requirements of the solar energy technologies are a factor of the full build-
18 out capacity, as well as assumptions on water use and technology operations discussed in
19 Appendix M. Table 8.3.9.2-2 lists the amounts of water needed for mirror/panel washing, potable
20 water supply, and cooling activities for each solar energy technology. At full build-out capacity,
21 the estimated total water use requirements for non-cooling technologies (i.e., technologies that
22 do not use water for cooling) during operations are 12 and 118 ac-ft/yr (14,800 to 146,000 m³/yr)
23 for the PV and dish engine technologies, respectively. For technologies that use water for
24 cooling (i.e., power tower and parabolic trough), total water needs range from 166 ac-ft/yr
25 (0.2 million m³) (power tower for an operating time of 30% using dry cooling) to 6,289 ac-ft/yr
26 (7.8 million m³/yr) (parabolic trough for an operating time of 60% using wet cooling).
27 Operations would generate up to 6 ac-ft/yr (7,400 m³/yr) of sanitary wastewater; in addition,
28 for wet-cooling technologies, 66 to 119 ac-ft/yr (81,400 to 147,000 m³/yr) of cooling system
29 blowdown water would need to be either treated on-site or sent to an off-site facility. Any on-site
30 treatment of wastewater would have to ensure that treatment ponds are effectively lined in order
31 to prevent any groundwater contamination.
32

33 Water demands during operations would most likely be met by withdrawing groundwater
34 from wells constructed on-site. The non-cooled technologies—PV system and dish engine—
35 would require well yields of 7 to 72 gpm (28 to 272 L/min), respectively. Cooled technologies
36 (parabolic trough and power tower) would require well yields from 102 to 393 gpm (389 to
37 1,490 L/min) for dry cooling and 723 to 3,900 gpm (2,740 to 14,800 L/min) for wet cooling. The
38 required well yields for non-cooled technologies are within the range of well yields within the
39 Lower Hassayampa Basin and are much less than the water demands for cooled technologies.
40 Cooled technology water demands (particularly wet cooling) could exceed the average annual
41 yield for a single well within the basin.
42

43 The water demands for technologies that require wet cooling are significant. For the
44 Phoenix AMA, groundwater use between 2001 and 2005 exceeded natural recharge by an
45 average of 790,000 ac-ft/yr (974 million m³/yr); however, artificial groundwater recharge credits
46 within the basin totaled approximately 1.46 million ac-ft (1.8 billion m³) as of the end of 2008

TABLE 8.3.9.2-2 Estimated Water Requirements during Operations at the Proposed Gillespie SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW) ^{a,b}	419	233	233	233
Water use requirements				
Mirror/panel washing (ac-ft/yr) ^{c,d}	209	116	116	12
Potable supply for workforce (ac-ft/yr)	6	3	3	0.3
Dry cooling (ac-ft/yr) ^e	84–419	47–233	NA ^f	NA
Wet cooling (ac-ft/yr) ^e	1,885–6,074	1,047–3,374	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	118	12
Dry-cooled technologies (ac-ft/yr)	299–634	166–352	NA	NA
Wet-cooled technologies (ac-ft/yr)	2,101–6,289	1,166–3,493	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr) ^g	119	66	NA	NA
Sanitary wastewater (ac-ft/yr)	6	3	3	0.3

- ^a Land area for parabolic trough was estimated at 5 acres/MW (0.02 km²/MW); land area for the power tower, dish engine, and PV technologies was estimated at 9 acres/MW (0.04 km²/MW).
- ^b Water needs are linearly related to power. Water usage for any other size project can be estimated by using multipliers provided in Table M.9-2 (Appendix M).
- ^c Value assumes a usage rate of 0.5 ac-ft/yr/MW for mirror washing for parabolic trough, power tower, and dish engine technologies and a rate of 0.05 ac-ft/yr/MW for panel washing for PV systems.
- ^d To convert ac-ft to m³, multiply by 1,234.
- ^e Dry-cooling value assumes 0.2 to 1.0 ac-ft/yr per MW and wet-cooling value assumes 4.5 to 14.5 ac-ft/yr per MW (range in these values represents 30 and 60% operating times) (DOE 2009a).
- ^f NA = not applicable.
- ^g Value scaled from 250-MW Beacon Solar project with an annual discharge of 44 gpm (167 L/min) (AECOM 2009). Blowdown estimates are relevant to wet cooling only.

1
2
3 (ADWR 2010a; ADWR 2010h). Based on the information presented here, using groundwater for
4 wet cooling for the full build-out scenario is not deemed feasible for the Gillespie SEZ. To the
5 extent possible, facilities using groundwater for dry cooling should implement water
6 conservation practices to limit water needs. Access to surface water supplies or treated effluent
7 for use by a solar project would depend on the availability of those resources and also on the
8 construction of a pipeline to convey water to the SEZ.
9

10 The availability of water rights and the impacts associated with groundwater withdrawals
11 or surface water use would need to be assessed during the site characterization phase of a
12 proposed solar project. Less water would be needed for any of the four solar technologies if the

1 full build-out capacity was reduced. The analysis of water use for the various solar technologies
2 assumed a single technology for full build-out. Water use requirements for development
3 scenarios that assume a mixture of solar technologies can be estimated using water use factors
4 described in Appendix M, Section M.9.

5
6 The effects of groundwater withdrawal rates on potential drawdown of groundwater
7 elevations and flow directions would need to be assessed during the site characterization phase
8 of a solar project and during the development of water supply wells. In the vicinity of the
9 proposed Gillespie SEZ, groundwater elevations declined by up to 90 ft (27.4 m) between the
10 1950s and 1998 (ADWR 1999). In portions of the Lower Hassayampa Basin, the land surface
11 is subsiding at a rate of about 0.8 in./yr (2 cm/yr) because of the declining groundwater levels
12 (ADWR 2010b). With these existing conditions, further groundwater withdrawals for solar
13 energy development could produce further drawdown of groundwater elevations and land
14 subsidence in the vicinity of the SEZ. These indirect impacts could disturb regional groundwater
15 flow patterns and recharge patterns, potentially affecting ecological habitats (see discussion in
16 Section 8.3.10).

17
18 Groundwater quality in the vicinity of the SEZ has concentrations of TDS, arsenic,
19 fluoride, and other constituents that exceed drinking quality standards (ADWR 2010a). Water
20 would need to be treated or imported to meet drinking water quality standards for potable water.

21 22 23 **Decommissioning/Reclamation**

24
25 During decommissioning/reclamation, all surface structures associated with the solar
26 project would be dismantled, and the site reclaimed to its preconstruction state. Activities and
27 water needs during this phase would be similar to those during the construction phase (dust
28 suppression and workforce potable supply) and may also include water to establish vegetation in
29 some areas. However, the total volume of water needed is expected to be less. Because quantities
30 of water needed during the decommissioning/reclamation phase would be less than those for
31 construction, impacts on surface and groundwater resources also would be less.

32 33 34 **8.3.9.2.3 Off-Site Impacts: Roads and Transmission Lines**

35
36 The proposed Gillespie SEZ is nearly adjacent to existing transmission lines, as described
37 in Section 8.3.1.2, but the SEZ is located approximately 3 mi (5 km) from the nearest state or
38 U.S. route (Old 80). Impacts associated with the construction of roads and transmission lines
39 deal primarily with water use demands for construction, water quality concerns relating to
40 potential chemical spills, and land disturbance effects on the natural hydrology. Water needed
41 for road construction (e.g., for soil compaction, dust suppression, and workforce potable supply)
42 could be trucked to the construction area from an off-site source. As a result, water use impacts
43 would be negligible. Impacts on surface water and groundwater quality resulting from spills
44 would be minimized by implementing the mitigation measures described in Section 5.9.3
45 (e.g., cleaning up spills as soon as they occur). Ground-disturbing activities that have the
46 potential to increase sediment and dissolved solid loads in downstream waters would be

1 conducted following the mitigation measures outlined in Section 5.9.3 to minimize impacts
2 associated with alterations to natural drainage pathways and hydrologic processes.
3
4

5 ***8.3.9.2.4 Summary of Impacts on Water Resources*** 6

7 The impacts on water resources from solar energy development at the proposed
8 Gillespie SEZ are associated with land disturbance effects on the natural hydrology, water
9 quality concerns, and water use requirements for the various solar energy technologies. Impacts
10 relating to water use requirements vary depending on the type of solar technology built and, for
11 technologies using cooling systems, the type of cooling (wet, dry, hybrid) employed. Water
12 requirements would be greatest for wet-cooled parabolic trough and power tower facilities.
13 Dry cooling reduces water use requirements by approximately a factor of 10 compared with
14 wet cooling. PV requires the least amount of water among the solar energy technologies. The
15 estimates of groundwater recharge, discharge, underflow from adjacent basins, and historical
16 data on groundwater extractions and groundwater surface elevations suggest that there is not
17 enough water available to support the water-intensive technologies, such as those using wet
18 cooling for the full build-out scenario.
19

20 Because the Gillespie SEZ is located within the Phoenix AMA, a permit would be
21 required for any groundwater supply wells dedicated to a solar facility. A permit would also be
22 required for use of surface water or effluent by a solar facility. Either way, a solar facility would
23 be required to demonstrate that there is an assured water supply for the life of the project. To use
24 any surface water or effluent, pipelines would need to be constructed and fees paid. Using
25 groundwater for the solar project in the basin (particularly for projects that use wet cooling)
26 would worsen overdraft conditions and could increase land subsidence in the vicinity of the solar
27 project. Calculations could be performed to determine the impact of the land subsidence on the
28 storage capacity of the underlying aquifer and the direction of groundwater flow. Use of
29 groundwater from a new well or an increased capacity on an existing well would also require a
30 hydrologic impact analysis report, as described above.
31

32 In addition, the water quality in many parts of the basin does not comply with drinking
33 water quality standards, so groundwater would need to be treated or potable water would need
34 to be imported into the area to support potable needs at solar energy facilities.
35

36 Land disturbance activities can cause localized erosion and sedimentation issues, as
37 well as alter groundwater recharge and discharge processes. Centennial Wash and its tributaries
38 provide significant recharge to the Lower Hassayampa Basin, and land disturbance activities in
39 the vicinity of the SEZ could significantly affect groundwater recharge to the basin. In addition,
40 land disturbance within the SEZ could affect channel erosion and sedimentation patterns in
41 Centennial Wash and its tributaries.
42
43
44

1 **8.3.9.3 SEZ-Specific Design Features and Design Feature Effectiveness**
2

3 Implementing the programmatic design features described in Appendix A, Section A.2.2,
4 as required under BLM’s Solar Energy Program, will mitigate some impacts on water resources.
5 Programmatic design features would focus on coordinating with federal, state, and local agencies
6 that regulate the use of water resources to meet the requirements of permits and approvals
7 needed to obtain water for development, and conducting hydrological studies to characterize the
8 aquifer from which groundwater would be obtained (including drawdown effects, if a new point
9 of diversion is created). The greatest consideration for mitigating water impacts would be in the
10 selection of solar technologies. The mitigation of impacts would be best achieved by selecting
11 technologies with low water demands.
12

13 Proposed design features specific to the proposed Gillespie SEZ include the following:
14

- 15 • Wet-cooling options would not be feasible if groundwater was the chosen
16 water source for a solar project, and other technologies should incorporate
17 water conservation measures;
18
- 19 • During site characterization, hydrologic investigations would need to identify
20 100-year floodplains and potential jurisdictional water bodies subject to Clean
21 Water Act Section 404 permitting. Siting of solar facilities and construction
22 activities should avoid areas identified as within a 100-year floodplain;
23
- 24 • Before drilling a new well, permits must be obtained from the ADWR, and all
25 groundwater rights policies of the ADWR must be followed (ADWR 2010c);
26
- 27 • Groundwater monitoring and production wells should be constructed in
28 accordance with state standards (ADWR 2010g);
29
- 30 • Stormwater management plans and BMPs should comply with standards
31 developed by the Arizona Department of Environmental Quality
32 (ADEQ 2010b);
33
- 34 • Water for potable uses would have to meet or be treated to meet drinking
35 water quality standards; and
36
- 37 • Land disturbance and operations activities should prevent erosion and
38 sedimentation in the vicinity of the ephemeral washes present on the site and
39 downstream in Centennial Wash.
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8.3.10 Vegetation

This section describes and discusses potential impacts on vegetation that could occur or is known to occur within the potentially affected area of the proposed Gillespie SEZ. The affected area considered in this assessment includes the areas of direct and indirect effects. The area of direct effects is defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and includes the SEZ and a 60-ft (18-m) wide portion of an assumed access road corridor. The area of indirect effects is defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1-mi (1.6-km) wide assumed access road corridor, where ground-disturbing activities would not occur but that could be indirectly affected by activities in the areas of direct effect.

Indirect effects considered in the assessment include effects from surface runoff, dust, and accidental spills from the SEZ and the road corridor, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ or road corridor. This area of indirect effects was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area is the area bounded by the areas of direct and indirect effects. These areas are defined and the impact assessment approach is described in Appendix M.

8.3.10.1 Affected Environment

The proposed Gillespie SEZ is located within the Sonoran Basin and Range Level III ecoregion (EPA 2007), which supports creosotebush (*Larrea tridentata*) white bursage (*Ambrosia dumosa*) plant communities with large areas of palo verde (*Parkinsonia microphyla*) - cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western honey mesquite (*Prosopis glandulosa var torreyana*) dominant in some areas (Turner and Brown 1994). Larger drainageways and washes support species of small trees and shrubs that may also occur in adjacent areas. Such species include western honey mesquite, ironwood (*Olneya tesota*), and blue paloverde (*Parkinsonia florida*), as well as species such as smoketree (*Psoralea spinosus*), which are mostly restricted to drainageways. Shrub species found in minor drainages include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola var. pentalepis*), Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). The proposed Gillespie SEZ is located in an area transitional to the Arizona Upland subdivision, which includes paloverde-cacti-mixed scrub communities. Annual precipitation in the Sonoran Desert occurs primarily in winter and summer (Turner and Brown 1994), and is low in the area of the SEZ, averaging about 7.6 in. (193 mm) at Tonopah, Arizona (see Section 8.3.13).

Land cover types, as described and mapped under SWReGAP (USGS 2005), were used to evaluate plant communities in and near the SEZ. Each cover type encompasses a range of

1 similar plant communities. Land cover types occurring within the potentially affected area of the
2 proposed Gillespie SEZ are shown in Figure 8.3.10.1-1. Table 8.3.10.1-1 provides the surface
3 area of each cover type within the potentially affected area.
4

5 Lands within the proposed Gillespie SEZ are classified primarily as Sonora–Mojave
6 Creosotebush–White Bursage Desert Scrub. Additional cover types within the SEZ are given in
7 Table 8.3.10.1-1. During a September 2009 visit to the site, the dominant species observed in
8 the sparse desertscrub communities present within the SEZ was creosotebush. Saguaro cactus,
9 paloverde, and ironwood, characteristic Sonoran Desert species, are present but infrequent.
10 Cacti species observed within the SEZ were saguaro cactus, pencil cholla (*Opuntia*), and barrel
11 cactus (*Ferocactus* sp.). Sensitive habitats on the SEZ include desert dry washes and dry wash
12 woodlands. The area has a history of livestock grazing, which likely has affected the plant
13 communities on the SEZ.
14

15 The area of indirect effects, including the area within 5 mi (8 km) around the SEZ and the
16 access road corridor, contains 13 cover types (listed in Table 8.3.10.1-1). The predominant cover
17 types are Sonora–Mojave Creosotebush–White Bursage Desert Scrub and Sonoran Paloverde-
18 Mixed Cacti Desert Scrub.
19

20 The eastern half of the Gillespie SEZ is included in the NWI; the western half is not
21 (USFWS 2009a). A riverine wetland is located just inside the southeast corner of the SEZ. No
22 other wetlands are mapped in the eastern half of the SEZ. NWI maps are produced from high-
23 altitude imagery and are subject to uncertainties inherent in image interpretation
24 (USFWS 2009a). This intermittently flooded wetland occurs along an unnamed wash that
25 extends from south of the SEZ to Centennial Wash northeast of the SEZ. The access road
26 corridor also crosses this riverine wetland near the SEZ. Large areas of wetland occur near the
27 eastern end of the access road corridor, associated with the Gila River and Arlington Canal, east
28 of Old Highway 80. These wetland areas primarily support scrub-shrub plant communities near
29 the Gila River and are part of an extensive area of riparian habitat mapped as North American
30 Warm Desert Riparian Woodland and Shrubland, North American Warm Desert Riparian
31 Mesquite Bosque, and Invasive Southwest Riparian Woodland and Shrubland. These riparian
32 habitats are dependent on groundwater discharge. Smaller areas of riparian habitat occur along
33 the Hassayampa River, northeast of the SEZ, and may also receive groundwater discharge.
34 Riverine wetlands occur along the Gila River and Arlington Canal. Wetlands with emergent
35 plant communities, including intermittently, temporarily, and seasonally flooded wetlands, also
36 occur in this area. Wetlands that are semipermanently flooded occur along the Gillespie Dam.
37 Within the 5-mile (8-km) area of indirect effects, an unnamed tributary of the Gila River south
38 of the SEZ is mapped as an intermittently flooded riverine wetland, and much of the Centennial
39 Wash north of the SEZ is mapped as a temporarily flooded riverine wetland, with scrub-shrub,
40 emergent, and sparsely vegetated (less than 30% vegetation cover) wetlands located near
41 Centennial Wash. The scrub-shrub wetlands are primarily mapped as North American Warm
42 Desert Riparian Mesquite Bosque. Two intermittently flooded palustrine wetlands with sparse
43 plant communities, about 1 acre (0.004 km²) in size, are located north of the SEZ, near the
44 northeastern boundary. These wetlands are formed by dikes across ephemeral washes. One of
45 these is mapped as North American Warm Desert Riparian Mesquite Bosque. A number of
46 small wetlands east of the SEZ were formed by excavation.

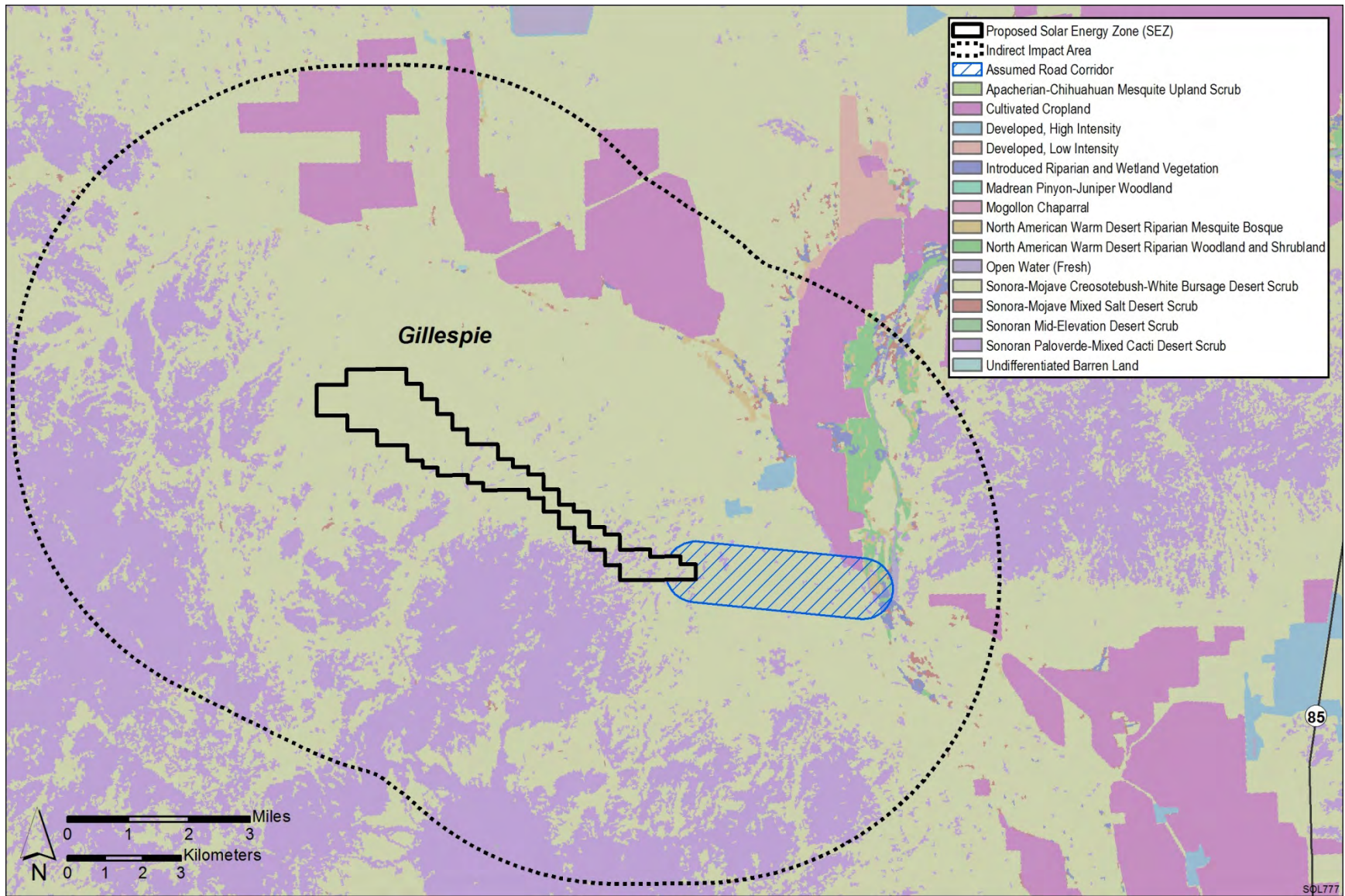


FIGURE 8.3.10.1-1 Land Cover Types within the Proposed Gillespie SEZ (Source: USGS 2004)

TABLE 8.3.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Gillespie SEZ and Potential Impacts

Land Cover Type ^a	Area of Cover Type Affected (acres) ^b			Overall Impact Magnitude ^f
	Within SEZ (Direct Effects) ^c	Assumed Access Road (Direct Effects) ^d	Corridor and Outside SEZ (Indirect Effects) ^e	
<p>Sonora–Mojave Creosotebush–White Bursage Desert Scrub: Occurs in broad valleys, lower bajadas, plains, and low hills in the Mojave and Sonoran deserts. Shrubs form a sparse to moderately dense cover (2%-50%), although the ground surface may be mostly barren. The dominant species are typically creosotebush (<i>Larrea tridentata</i>) and white bursage (<i>Ambrosia dumosa</i>). Other shrubs, dwarf-shrubs, and cacti may also be dominant or form sparse understories. Herbaceous species are typically sparse, but may be seasonally abundant.</p>	2,482 acres ^g (0.1%, 0.2%)	19 acres (<0.1%)	57,863 acres (2.1%)	Small
<p>Sonoran Paloverde-Mixed Cacti Desert Scrub: Occurs on hillsides, mesas, and upper bajadas. The tall shrubs yellow paloverde (<i>Parkinsonia microphylla</i>) and creosotebush (<i>Larrea tridentata</i>), which are sparse to moderately dense, and/or sparse saguaro cactus (<i>Carnegiea gigantea</i>) characterize the vegetation. Other shrubs and cacti are typically present. Perennial grasses and forbs are sparse. Annual species are seasonally present and may be abundant.</p>	131 acres (<0.1%, <0.1%)	1 acre (<0.1%)	28154 acres (1.8%)	Small
<p>North American Warm Desert Riparian Mesquite Bosque: Occurs along perennial and intermittent streams as relatively dense riparian corridors composed of trees and shrubs. Honey mesquite (<i>Prosopis glandulosa</i>) and velvet mesquite (<i>P. velutina</i>) are the dominant trees. Vegetation is supported by groundwater when surface water is absent.</p>	0 acres	1 acre (<0.1%)	529 acres (3.2%)	Small
<p>North American Warm Desert Riparian Woodland and Shrubland: Occurs along medium to large perennial streams in canyons and desert valleys. Consists of a mix of riparian woodlands and shrublands. Vegetation is dependent upon annual or periodic flooding, along with substrate scouring, and/or a seasonally shallow water table.</p>	0 acres	1 acre (<0.1%)	1,027 acres (8.5%)	Small

TABLE 8.3.10.1-1 (Cont.)

Land Cover Type ^a	Area of Cover Type Affected (acres) ^b			Overall Impact Magnitude ^f
	Within SEZ (Direct Effects) ^c	Assumed Access Road (Direct Effects) ^d	Corridor and Outside SEZ (Indirect Effects) ^e	
Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	0 acres	<1 acre (<0.1%)	10,335 acres (2.6%)	Small
Invasive Southwest Riparian Woodland and Shrubland: Dominated by non-native riparian trees and shrubs.	0 acres	<1 acre (<0.1%)	446 acres (2.0%)	Small
Apacherian-Chihuahuan Mesquite Upland Scrub: Occurs on foothills where deeper soil layers store winter precipitation. Dominant species are western honey mesquite (<i>Prosopis glandulosa</i>) or velvet mesquite (<i>P. velutina</i>) along with other deep-rooted shrubs and succulents. Cover of grasses is low.	0 acres	<1 acre (<0.1%)	15 acres (0.3%)	Small
Sonora-Mojave Mixed Salt Desert Scrub: Extensive open-canopied shrublands in the Mojave and Sonoran deserts, usually occurring around playas and in valley bottoms or basins with saline soils. Vegetation is typically composed of one or more <i>Atriplex</i> species; other salt-tolerant plants are often present or even codominant. Grasses occur at varying densities.	0 acres	<1 acre (<0.1%)	312 acres (0.8%)	Small
Open Water: Plant or soil cover is generally less than 25%.	0 acres	<1 acre (<0.1%)	96 acres (3.9%)	Small
Developed, Medium-High Density: Includes housing and commercial/industrial development. Impervious surfaces compose 50%-100% of the total land cover.	0 acres	0 acres	209 acres (0.1%)	Small

TABLE 8.3.10.1-1 (Cont.)

Land Cover Type ^a	Area of Cover Type Affected (acres) ^b			Overall Impact Magnitude ^f
	Within SEZ (Direct Effects) ^c	Assumed Access Road (Direct Effects) ^d	Corridor and Outside SEZ (Indirect Effects) ^e	
Developed, Open Space – Low Intensity: Includes housing, parks, golf courses, and other areas planted in developed settings. Impervious surfaces constitute up to 49% of the total land cover.	0 acres	0 acres	27 acres (0.1%)	Small
Barren lands non-specific: Includes a variety of barren areas, generally with less than 15% cover of vegetation.	0 acres	0 acres	26 acres (0.6%)	Small
Sonoran Mid-Elevation Desert Scrub: Occurs on lower slopes along the northern edge of the Sonoran Desert. Generally consists of an open shrub layer and a generally sparse herbaceous layer.	0 acres	0 acres	1 acre (<0.1 %)	Small

^a Land cover descriptions are from USGS (2005). Full descriptions of land cover types, including plant species, can be found in Appendix I.

^b Area in acres, determined from USGS (2004).

^c Includes the area of the cover type within the SEZ, the percentage that area represents of all occurrences of that cover type within the SEZ region (i.e., a 50-mi [80-km] radius from the center of the SEZ), and the percentage that area represents of all occurrences of that cover type on BLM lands within the SEZ region.

^d For access road development, direct effects were estimated within a 3-mi (4.8-km) long, 60-ft (18-m) wide road ROW from the SEZ to the nearest highway. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide road corridor. Impacts are for the area of the cover type within the assumed ROW, and the percentage that area represents of all occurrences of that cover type within the SEZ region.

^e Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portions of the 1-mi (1.6-km) wide access road corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project facilities. The potential degree of indirect effects would decrease with increasing distance from the SEZ. Includes the area of the cover type within the indirect effects area and the percentage that area represents of all occurrences of that cover type within the SEZ region.

^f Overall impact magnitude categories were based on professional judgment and were (1) *small*: a relatively small proportion ($\leq 1\%$) of the cover type within the SEZ region would be lost; (2) *moderate*: an intermediate proportion (> 1 but $\leq 10\%$) of a cover type would be lost; and (3) *large*: $> 10\%$ of a cover type would be lost.

^g To convert acres to km², multiply by 0.004047.

1 Numerous ephemeral dry washes occur within the SEZ, generally flowing northeast to
 2 Centennial Wash. These dry washes typically contain water for short periods during or following
 3 precipitation events and likely include temporarily flooded areas. Although these washes
 4 generally do not support wetland or riparian habitats, woodlands occur along the margins of a
 5 number of the larger washes.

6
 7 The State of Arizona maintains an official list of weed species that are designated
 8 noxious species (AZDA 2010). Table 8.3.10.1-2 summarizes the noxious weed species regulated
 9 in Arizona that are known to occur in Maricopa County (USDA 2010b), which includes the
 10 proposed Gillespie SEZ.

11
 12 The Arizona Department of Agriculture classifies noxious weeds into one of three
 13 categories (AZDA 2010):

- 14 • “Prohibited: Noxious weeds (includes plants, stolons, rhizomes, cuttings, and
 15 seed) that are prohibited from entry into the state.”
- 16
 17 • “Regulated: Noxious weeds that are regulated (includes plants, stolons,
 18 rhizomes, cuttings, and seed) and if found within the state may be controlled
 19 or quarantined to prevent further infestation or contamination.”
- 20
 21 • “Restricted: Noxious weeds that are restricted (includes plants, stolons,
 22 rhizomes, cuttings, and seed) and if found within the state shall be quarantined
 23 to prevent further infestation or contamination.”
- 24
 25
 26

TABLE 8.3.10.1-2 Designated Noxious Weeds of Arizona Occurring in Maricopa County

Common Name	Scientific Name	Category
African rue	<i>Peganum harmala</i>	Prohibited
Buffelgrass	<i>Pennisetum ciliare</i>	Regulated, Prohibited
Burclover	<i>Medicago polymorpha</i>	Regulated, Prohibited
Camelthorn	<i>Alhagi pseudalhagi</i>	Restricted, Prohibited
Common purslane	<i>Portulaca oleracea</i>	Regulated, Prohibited
Floating water hyacinth	<i>Eichhornia crassipes</i>	Regulated, Restricted, Prohibited
Dodder	<i>Cuscuta</i> spp.	Restricted, Prohibited
Field bindweed	<i>Convolvulus arvensis</i>	Regulated, Prohibited
Field sandbur	<i>Cenchrus incertus</i>	Regulated, Prohibited
Hydrilla	<i>Hydrill verticillata</i>	Prohibited
Morning glory	<i>Ipomoea</i> spp.	Prohibited
Puncture vine	<i>Tribulus terrestris</i>	Regulated, Prohibited
Russian knapweed	<i>Acroptilon repens</i>	Restricted, Prohibited
Southern sandbur	<i>Cenchrus echinatus</i>	Regulated, Prohibited

Sources: AZDA (2010); USDA (2010b).

1 Many invasive plant species that are not designated as noxious weeds also occur in
2 Maricopa County, and include cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*),
3 Arabian schismus (*Schismus arabicus*), Mediterranean grass (*Schismus barbatus*), fountaingrass
4 (*Pennisetum setaceum*), Sahara mustard (*Brassica tournefortii*), and saltcedar (*Tamarix* spp.)
5 (USDA 2010b). No noxious weed or invasive plant species was observed on the SEZ in
6 August 2009.

7 8 9 **8.3.10.2 Impacts**

10
11 The construction of solar energy facilities within the proposed Gillespie SEZ would
12 result in direct impacts on plant communities due to the removal of vegetation within the facility
13 footprint during land-clearing and land-grading operations. About 80% of the SEZ (2,094 acres
14 [8.5 km²]) would be expected to be cleared with full development of the SEZ. The plant
15 communities affected would depend on facility locations, and could include any of the
16 communities occurring on the SEZ. Therefore, for the purposes of this analysis, all of the area
17 of each cover type within the SEZ is considered to be directly affected by removal with full
18 development of the SEZ.

19
20 Indirect effects (caused, for example, by surface runoff or dust from the SEZ) have the
21 potential to degrade affected plant communities and may reduce biodiversity by promoting the
22 decline or elimination of species sensitive to disturbance. Indirect effects can also cause an
23 increase in disturbance-tolerant species or invasive species. High impact levels could result in the
24 elimination of a community or the replacement of one community type by another. The proper
25 implementation of programmatic design features, however, would reduce indirect effects to a
26 minor or small level of impact.

27
28 Possible impacts from solar energy facilities on vegetation that are encountered within
29 the SEZ, as well as general mitigation measures, are described in more detail in Section 5.10.4.
30 Any such impacts would be minimized through the implementation of required programmatic
31 design features described in Appendix A, Section A.2.2 (selected from the general mitigation
32 measures) and from any additional mitigation applied.

33 34 35 **8.3.10.2.1 Impacts on Native Species**

36
37 The impacts of construction, operation, and decommissioning were considered small if
38 the impact would affect a relatively small proportion ($\leq 1\%$) of the cover type in the SEZ region
39 (within 50 mi [80 km] of the center of the SEZ); a moderate impact could affect an intermediate
40 proportion (> 1 but $\leq 10\%$) of cover type; a large impact could affect greater than 10% of a
41 cover type.

42
43 Solar facility construction and operation in the proposed Gillespie SEZ would primarily
44 affect communities of the Sonora–Mojave Creosotebush–White Bursage Desert Scrub cover
45 type. One additional cover type that would be affected within the SEZ is Sonoran Paloverde-
46 Mixed Cacti Desert Scrub. Table 8.3.10.1-1 summarizes the potential impacts on land cover

1 types resulting from development of solar energy facilities in the proposed Gillespie SEZ. These
2 cover types are relatively common in the SEZ region. Desert dry washes and dry wash
3 woodlands are important sensitive habitats in the region.
4

5 Several cover types that would potentially be affected by the access road ROW are
6 relatively uncommon, representing 1% or less of the land area within the SEZ region: Sonora-
7 Mojave Mixed Salt Desert Scrub (0.8%), Open Water (0.05%), and Invasive Southwest
8 Riparian Woodland and Shrubland (0.4%), North American Warm Desert Riparian Mesquite
9 Bosque (0.3%), North American Warm Desert Riparian Woodland and Shrubland (0.2%),
10 Apacherian-Chihuahuan Mesquite Upland Scrub (0.1%). The Invasive Southwest Riparian
11 Woodland and Shrubland cover type likely includes few native species.
12

13 The construction, operation, and decommissioning of solar projects within the proposed
14 Gillespie SEZ would result in small impacts on all cover types in the affected area.
15

16 Because of the arid conditions, re-establishment of desert scrub communities in
17 temporarily disturbed areas would likely be very difficult and might require extended periods
18 of time. In addition, noxious weeds could become established in disturbed areas and colonize
19 adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in
20 widespread habitat degradation. Cryptogamic soil crusts occur in many of the shrubland
21 communities in the region and likely occur on the SEZ. Damage to these crusts, such as by the
22 operation of heavy equipment or other vehicles, can alter important soil characteristics, such as
23 nutrient cycling and availability, and affect plant community characteristics (Lovich and
24 Bainbridge 1999).
25

26 The deposition of fugitive dust from large areas of disturbed soil onto habitats outside
27 a solar project area could result in reduced productivity or changes in plant community
28 composition. Fugitive dust deposition could affect plant communities of each of the cover
29 types occurring within the area of indirect effects identified in Table 8.3.10.1-1.
30

31 The riverine wetland in the southeast corner of the SEZ could be directly impacted during
32 site grading if fill material is placed within the channel of the unnamed stream. Grading near the
33 wetland could disrupt surface water or groundwater flow characteristics, resulting in changes in
34 the frequency, duration, depth, or extent of inundation or soil saturation, and could potentially
35 alter wetland plant communities and affect wetland function. Increases in surface runoff from a
36 solar energy project site could also affect the hydrologic characteristics of the riverine wetland.
37 The introduction of contaminants into wetlands in or near the SEZ could result from spills of
38 fuels or other materials used on a project site. Soil disturbance could result in sedimentation in
39 wetland areas, which could degrade or eliminate wetland plant communities. Sedimentation
40 effects or hydrologic changes could also extend to wetlands outside of the SEZ, such as the
41 palustrine wetlands near the northern boundary of the SEZ. Wetlands along or near Centennial
42 Wash, north of the SEZ, could be affected by sedimentation, erosion, or hydrologic changes as
43 a result of solar project activities in the SEZ.
44

45 Grading could also affect desert dry washes within the SEZ and access road corridor.
46 Several desert washes in the SEZ and corridor support woodland communities of paloverde,

1 ironwood, and mesquite. Alteration of surface drainage patterns or hydrology could adversely
2 affect downstream dry wash communities. Vegetation within these communities could be lost by
3 erosion or desiccation. Communities associated with intermittently flooded areas downgradient
4 from solar projects in the SEZ could be affected by ground-disturbing activities. Site clearing
5 and grading could result in hydrologic changes and could potentially alter plant communities and
6 affect community function. Increases in surface runoff from a solar energy project site could also
7 affect hydrologic characteristics of these communities. The introduction of contaminants into
8 these habitats could result from spills of fuels or other materials used on a project site. Soil
9 disturbance could result in sedimentation in these areas, which could degrade or eliminate
10 sensitive plant communities. Section 8.3.9 contains further discussion of impacts on washes.
11 Direct impacts on desert washes that are waters of the United States would require permitting
12 from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.
13

14 The construction of an access road to Old U.S. 80 potentially could result in impacts
15 on wetlands and riparian habitat that occur within the assumed access road corridor. Areas of
16 palustrine and riverine wetlands, mapped as open water, North American Warm Desert Riparian
17 Mesquite Bosque, North American Warm Desert Riparian Woodland and Shrubland, and
18 Invasive Southwest Riparian Woodland and Shrubland occur within the presumed access road
19 corridor. These wetland and riparian habitats are associated with the Gila River and, although
20 they could be indirectly impacted by access roads, would be unlikely to be directly impacted.
21

22 Although the use of groundwater within the Gillespie SEZ for technologies with high
23 water requirements, such as wet-cooling systems, may be unlikely, groundwater withdrawals
24 for such systems could reduce groundwater elevations (see Section 8.3.9). In addition, impacts
25 from land disturbance to drainages on the SEZ that are tributaries of Centennial Wash could
26 adversely affect groundwater recharge processes. Plant communities in the vicinity of the SEZ
27 that depend on accessible groundwater, such as riparian woodland and shrubland or mesquite
28 bosque communities, could become degraded or lost as a result of lowered groundwater levels.
29 Because the Gila River receives groundwater discharge, scrub-shrub, emergent, and other
30 wetland and riparian habitats along the river could be affected by lower groundwater levels.
31 Riparian habitats along the Hassayampa River may be dependent on groundwater discharges,
32 and could also be affected.
33
34

35 ***8.3.10.2 Impacts from Noxious Weeds and Invasive Plant Species***

36

37 Executive Order 13112, “Invasive Species” (*Federal Register*, Volume 64, page 61836,
38 Feb. 8, 1999) directs federal agencies to prevent the introduction of invasive species and provide
39 for their control and to minimize the economic, ecological, and human health impacts of invasive
40 species. Potential impacts of noxious weeds and invasive plant species resulting from solar
41 energy facilities are described in Section 5.10.1. Despite required programmatic design features
42 to prevent the spread of noxious weeds, project disturbance could potentially increase the
43 prevalence of noxious weeds and invasive species in the affected area of the proposed Gillespie
44 SEZ, such that weeds could be transported into areas that were previously relatively weed-free.
45 This situation could result in reduced restoration success and possible widespread habitat
46 degradation. Areas of invasive species near the SEZ include about 446 acres (1.8 km²) of

1 Invasive Southwest Riparian Woodland and Shrubland which occurs within the area of indirect
2 effects. Species designated as noxious weeds in Arizona known to occur in Maricopa County are
3 listed in Table 8.3.10.1-2.

4
5 Approximately 209 acres (0.85 km²) of the Developed, Medium-High Density and
6 27 acres (0.1 km²) of Developed, Open Space–Low Intensity cover type occurs within the area
7 of indirect effects. Disturbance associated with solar project development may promote
8 establishment and spread of invasive species that are associated with these cover types. Past or
9 present land uses such as grazing or recreational OHV use within the SEZ area of potential
10 impacts may affect the susceptibility of plant communities to the establishment of noxious weeds
11 and invasive species. Disturbance associated with existing roads and transmission lines within
12 the SEZ area of potential impacts also likely contributes to the susceptibility of plant
13 communities to the establishment and spread of noxious weeds and invasive species.

14 15 16 **8.3.10.3 SEZ-Specific Design Features and Design Feature Effectiveness**

17
18 In addition to programmatic design features, SEZ-specific design features would reduce
19 the potential for impacts on plant communities. While the specifics of some of these practices are
20 best established when considering specific project details, some measures can be identified at
21 this time, as follows.

- 22
23 • An Integrated Vegetation Management Plan, addressing invasive species
24 control, and an Ecological Resources Mitigation and Monitoring Plan,
25 addressing habitat restoration, should be approved and implemented to
26 increase the potential for successful restoration of Creosotebush-White
27 Bursage Desert Scrub and Sonoran Paloverde-Mixed Cacti Desert Scrub
28 communities, as well as other affected habitats, and minimize the potential for
29 the spread of invasive species or noxious weeds, such as those occurring in
30 Maricopa County, that could be introduced as a result of solar energy project
31 activities (see Section 8.3.10.2.2). Invasive species control should focus on
32 biological and mechanical methods where possible to reduce the use of
33 herbicides.
- 34
35 • All wetland, dry wash, dry wash woodland, mesquite bosque, riparian, and
36 saguaro cactus communities within the SEZ or access road corridor should be
37 avoided to the extent practicable, and any impacts minimized and mitigated.
38 Any cacti that cannot be avoided should be salvaged. A buffer area should be
39 maintained around dry washes, dry wash woodland, mesquite bosque,
40 wetland, and riparian habitats to reduce the potential for impacts.
- 41
42 • Appropriate engineering controls should be used to minimize impacts on
43 wetland, dry wash, dry wash woodland, mesquite bosque, and riparian
44 habitats, including downstream occurrences, resulting from surface water
45 runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive

1 dust deposition to these habitats. Appropriate buffers and engineering controls
2 would be determined through agency consultation.

- 3
4 • Groundwater withdrawals should be limited to reduce the potential for indirect
5 impacts on groundwater-dependent communities, such as mesquite bosque
6 communities or riparian habitats along the Gila or Hassayampa Rivers.

7
8 If these SEZ-specific design features are implemented in addition to other programmatic
9 design features, it is anticipated that a high potential for impacts from invasive species and
10 potential impacts on wetland, dry wash, dry wash woodland, riparian, mesquite bosque, and
11 saguaro cactus communities would be reduced to a minimal potential for impacts.
12

8.3.11 Wildlife and Aquatic Biota

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could occur within the potentially affected area of the proposed Gillespie SEZ. Wildlife known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from the following references: Arizona Field Ornithologists (2010), Brennan (2008), Hoffmeister (1986), and SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005, 2007). The amount of aquatic habitat within the SEZ region was determined by using available GIS surface water datasets to estimate the length of linear perennial stream features and the area of standing water body features (i.e., ponds, lakes, and reservoirs) within 50 mi (80 km) of the SEZ.

The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and included the SEZ and a 60-ft (18-m) wide portion of an assumed 3-mi (4.8-km) long access road. The maximum developed area within the SEZ would be 2,094 acres (8.5 km²), and the maximum developed area within the access road corridor would be 22 acres (0.1 km²).

The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1.0-mi (1.6-km) wide assumed access road corridor where ground-disturbing activities would not occur, but that could be indirectly affected by activities in the area of direct effects (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or road construction area). (For the proposed Gillespie SEZ, the indirectly affected area for the access road occurs within the area of indirect effects for the SEZ.) Potentially suitable habitat for a species within the SEZ greater than the maximum of 2,094 acres (8.5 km²) of direct effects was also included as part of the area of indirect effects. The potential magnitude of indirect effects would decrease with increasing distance from the SEZ. The area of indirect effects was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to such effects. These areas of direct and indirect effects are defined and the impact assessment approach is described in Appendix M.

The primary land cover habitat type within the affected area is Sonora-Mojave creosotebush-white bursage desert scrub (see Section 8.3.10). No aquatic or wetland habitats occur on the SEZ. Aquatic habitats that occur within the area of indirect effects include Winters Wash, Centennial Wash, Gila River, and Gila Bend Canal. A number of other washes, creeks, rivers, and canals occur within the SEZ region (Figure 8.3.9.1-1).

8.3.11.1 Amphibians and Reptiles

8.3.11.1.1 Affected Environment

This section addresses amphibian and reptile species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the

1 proposed Gillespie SEZ. The list of amphibian and reptile species potentially present in the
2 project area was determined from species lists available from Brennan (2008) and range maps
3 and habitat information available from the SWReGAP (USGS 2007). Land cover types suitable
4 for each species were determined from SWReGAP (USGS 2004, 2005, 2007). See Appendix M
5 for additional information on the approach used.
6

7 On the basis of species distributions within the area of the SEZ and habitat preferences
8 of the amphibian species, the Great Basin spadefoot (*Spea intermontana*) and red-spotted toad
9 (*Bufo punctatus*) would be expected to occur within the SEZ (Brennan 2008; USGS 2007;
10 Stebbins 2003). However, breeding habitat for these species is not present within the SEZ.
11 Breeding habitat for these species would be present in Winters Wash, Centennial Wash, and
12 Gila River in the area of indirect effects.
13

14 More than 30 reptile species occur within the area that encompasses the proposed
15 Gillespie SEZ (Brennan 2008; USGS 2007; Stebbins 2003). The desert tortoise (*Gopherus*
16 *agassizii*), a federal and state-listed threatened species, is discussed in Section 11.2.12. Lizard
17 species expected to occur within the SEZ include the desert horned lizard (*Phrynosoma*
18 *platyrhinos*), Great Basin collared lizard (*Crotaphytus bicinctores*), side-blotched lizard (*Uta*
19 *stansburiana*), western whiptail (*Cnemidophorus tigris*), and zebra-tailed lizard (*Callisaurus*
20 *draconoides*).
21

22 Snake species expected to occur within the SEZ include the coachwhip (*Masticophis*
23 *flagellum*), common kingsnake (*Lampropeltis gentula*), glossy snake (*Arizona elegans*),
24 gophersnake (*Pituophis catenifer*), groundsnake (*Sonora semiannulata*), and nightsnake
25 (*Hypsiglena torquata*). The Mohave rattlesnake (*Crotalus scutulatus*), sidewinder (*C. cerastes*)
26 and western diamond-backed rattlesnake (*C. atrox*) would be the most common poisonous snake
27 species expected to occur on the SEZ.
28

29 Table 8.3.11.1-1 provides habitat information for representative amphibian and reptile
30 species that could occur within the proposed Gillespie SEZ.
31
32

33 **8.3.11.1.2 Impacts** 34

35 The types of impacts that amphibians and reptiles could incur from construction,
36 operation, and decommissioning of utility-scale solar energy facilities are discussed in
37 Section 5.10.2.1. Any such impacts would be minimized through the implementation of required
38 programmatic design features described in Appendix A, Section A.2.2, and through any
39 additional mitigation applied. Section 8.3.11.1.3 identifies SEZ-specific design features of
40 particular relevance to the proposed Gillespie SEZ.
41

42 The assessment of impacts on amphibian and reptile species is based on available
43 information on the presence of species in the affected area as presented in Section 8.3.11.1.1
44 following the analysis approach described in Appendix M. Additional NEPA assessments and
45 coordination with state natural resource agencies may be needed to address project-specific
46

TABLE 8.3.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur in the Affected Area of the Proposed Gillespie SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Amphibians					
Great Basin spadefoot (<i>Spea intermontana</i>)	Sagebrush flats, semidesert shrublands, pinyon-juniper woodlands, and spruce-fir forests. Breeds in temporary and permanent waters including rain pools, pools in intermittent streams, and flooded areas along streams. About 2,760,300 acres ^h of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat) during construction and operations	59,188 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Red-spotted toad (<i>Bufo punctatus</i>)	Dry, rocky areas at lower elevations near desert springs and persistent pools along rocky arroyos, desert streams and oases, open grassland, scrubland oaks, and dry woodlands. About 4,325,500 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,864 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Lizards					
Desert horned lizard (<i>Phrynosoma platyrhinos</i>)	Deserts dominated by sagebrush, creosotebush, greasewood, or cactus. Occurs on sandy flats, alluvial fans, washes, and edge of dunes. Burrows in soil during periods of inactivity. About 4,347,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,405 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,916 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Lizards (Cont.)					
Great Basin collared lizard (<i>Crotaphytus bicinctores</i>)	Usually inhabits alluvia, lava flows, mountain slopes, canyons, buttes, rock outcrops, washes, and rocky plains. Limiting factors are the presence of large boulders and open/sparse vegetation. About 4,318,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,849 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Side-blotched lizard (<i>Uta stansburiana</i>)	Low to moderate elevations in washes, arroyos, boulder-strewn ravines, rocky cliff bases, and flat shrubby areas in canyon bottoms. Often along sandy washes. Usually in areas with a lot of bare ground. About 4,264,100 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,551 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Western whiptail (<i>Cnemidophorus tigris</i>)	Arid and semiarid habitats with sparse plant cover. About 4,318,800 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,108 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Lizards (Cont.)					
Zebra-tailed lizard (<i>Callisaurus draconoides</i>)	Open, warm-desert habitats, especially dry washes and canyons with fine gravel and sand. About 4,330,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,419 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Snakes					
Coachwhip (<i>Masticophis flagellum</i>)	Creosotebush desert, shortgrass prairie, shrub-covered flats and hills. Sandy to rocky substrates. Avoids dense vegetation. About 4,264,000 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,551 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Common kingsnake (<i>Lampropeltis getula</i>)	Coniferous forests, woodlands, swampland, coastal marshes, river bottoms, farmlands, prairies, chaparral, and deserts. Uses rock outcrops and rodent burrows for cover. About 4,750,600 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,755 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Snakes (Cont.)					
Glossy snake (<i>Arizona elegans</i>)	Light shrubby to barren deserts, sagebrush flats, grasslands, and chaparral-covered slopes and woodlands. Prefers sandy grasslands, shrublands and woodlands. About 4,279,200 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,080 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Gophersnake (<i>Pituophis catenifer</i>)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 4,988,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,991 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Groundsnake (<i>Sonora semiannulata</i>)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 4,315,300 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,108 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Snakes (Cont.)					
Mohave rattlesnake (<i>Crotalus scutulatus</i>)	Upland desert and lower mountain slopes including barren desert, grassland, open juniper woodland, and scrubland. Especially common in areas of scattered scrubby growth such as creosote and mesquite. About 4,994,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	99,558 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Nightsnake (<i>Hypsiglena torquata</i>)	Arid and semiarid desert flats, plains, and woodlands; areas with rocky and sandy soils are preferred. During cold periods of the year, it seeks refuge underground, in crevices, or under rocks. About 4,267,400 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,551 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Sidewinder (<i>Crotalus cerastes</i>)	Windblown sand habitats near rodent burrows. Most common in areas of sand hummocks topped with creosote, mesquite, or other desert plants. About 4,269,000 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,563 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Snakes (Cont.)					
Western diamond- backed rattlesnake (<i>Crotalus atrox</i>)	Dry and semidry lowland areas. Usually found in brush-covered plains, dry washes, rock outcrops, and desert foothills. About 4,797,200 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,782 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 2,094 acres of direct effects within the SEZ was assumed.

^c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 2,094 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ.

^e For access road development, direct effects were estimated within a 3-mi (4.8-km) long, 60-ft (18-m) wide access road ROW from the SEZ to Old Highway 80. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.3.11.1-1 (Cont.)

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- ^f Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^g Species-specific mitigation measures are suggested here, but final mitigation measures should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ^h To convert acres to km^2 , multiply by 0.004047.

Sources: Brennan (2008); CDFG (2008); NatureServe (2010); USGS (2004, 2005, 2007).

1 impacts more thoroughly. These assessments and consultations could result in additional
2 required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 8.3.11.1.3).

3
4 In general, impacts on amphibians and reptiles would result from habitat disturbance
5 (i.e., habitat reduction, fragmentation, and alteration) and from disturbance, injury, or mortality
6 to individual amphibians and reptiles. On the basis of the impacts on amphibians and reptiles
7 summarized in Table 8.3.11.1-1, direct impacts on representative amphibian and reptile species
8 would be small, ranging from a high of 0.08% for the Great Basin spadefoot to only 0.04 to
9 0.05% for all other species (Table 8.3.11.1-1). Larger areas of potentially suitable habitats for
10 the amphibian and reptile species occur within the area of potential indirect effects (i.e., 2.1% to
11 2.2% for all species). Indirect impacts on amphibians and reptiles could result from surface water
12 and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental
13 spills, collection, and harassment. These indirect impacts are expected to be negligible with
14 implementation of programmatic design features.

15
16 Decommissioning of facilities and reclamation of disturbed areas after operations cease
17 could result in short-term adverse impacts on individuals and habitats adjacent to project areas,
18 but long-term benefits would accrue if suitable habitats were restored in previously disturbed
19 areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and
20 reclamation on wildlife. Of particular importance for amphibian and reptile species would be the
21 restoration of original ground surface contours, soils, and native plant communities associated
22 with desert scrub, playa, and wash habitats.

23 24 25 ***8.3.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness***

26
27 The implementation of required programmatic design features described in Appendix A,
28 Section A.2.2, would reduce the potential for effects on amphibians and reptiles. Indirect impacts
29 could be reduced to negligible levels by implementing programmatic design features, especially
30 those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust.
31 SEZ-specific design features are best established when considering specific project details.
32 However, because potentially suitable habitats for the representative amphibian and reptile
33 species occur throughout much of the SEZ, additional species-specific mitigation of direct
34 effects for those species would be difficult or infeasible.

1 **8.3.11.2 Birds**

2
3
4 **8.3.11.2.1 Affected Environment**

5
6 This section addresses bird species that
7 are known to occur, or for which potentially
8 suitable habitat occurs, on or within the
9 potentially affected area of the proposed
10 Gillespie SEZ. The list of bird species
11 potentially present in the project area was
12 determined from the Arizona Field
13 Ornithologists (2010) and range maps and
14 habitat information available from the SWReGAP (USGS 2007). Land cover types suitable for
15 each species were determined from SWReGAP (USGS 2004, 2005, 2007). See Appendix M for
16 additional information on the approach used.

Desert Focal Bird Species
Bird species whose requirements define spatial attributes, habitat characteristics, and management regimes representative of a healthy desert system (Chase and Geupel 2005).

17
18 Twelve of the bird species that could occur in the affected area of the SEZ are considered
19 focal species in the *Desert Bird Conservation Plan* (CalPIF 2009): ash-throated flycatcher
20 (*Myiarchus cinerascens*), black-tailed gnatcatcher (*Polioptila melanura*), black-throated sparrow
21 (*Amphispiza bilineata*), burrowing owl (*Athene cunicularia*), common raven (*Corvus corax*),
22 Costa’s hummingbird (*Calypte costae*), Gila woodpecker (*Melanerpes uropygialis*), ladder-
23 backed woodpecker (*Picoides scalaris*), Le Conte’s thrasher (*Toxostoma lecontei*), Lucy’s
24 warbler (*Vermivora luciae*), phainopepla (*Phainopepla nitens*), and verdin (*Auriparus flaviceps*).
25 Habitats for most of these species are described in Table 8.3.11.2-1. Because of its special
26 species status, the burrowing owl is discussed in Section 8.3.12.1.

27
28
29 **Waterfowl, Wading Birds, and Shorebirds**

30
31 As discussed in Section 4.10.2.2.2, waterfowl (ducks, geese, and swans), wading birds
32 (herons and cranes), and shorebirds (avocets, gulls, plovers, rails, sandpipers, stilts, and terns) are
33 among the most abundant groups of birds in the six-state solar study area. However, within the
34 proposed Gillespie SEZ, waterfowl, wading birds, and shorebird species would be mostly absent.
35 Centennial Wash, Winters Wash, Gila River, and Gila Bend Canal within the area of indirect
36 effects may attract some species. However, the Arizona Canal, Beardsley Canal, Buckeye Canal,
37 Gila Bend Canal, Gila River, Grand Canal, Hassayampa River, Roosevelt Canal, and Salt River
38 that occur within the 50-mi (80-km) SEZ region would provide more viable habitat for this group
39 of birds.

40
41
42 **Neotropical Migrants**

43
44 As discussed in Section 4.10.2.2.3, neotropical migrants represent the most diverse
45 category of birds within the six-state solar energy study area. Species expected to occur within
46

TABLE 8.3.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur in the Affected Area of the Proposed Gillespie SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Neotropical Migrants</i>					
Ash-throated flycatcher (<i>Myiarchus cinerascens</i>)	Common in scrub and woodland habitats including desert riparian and desert washes. Requires hole/cavity for nesting. Uses shrubs or small trees for foraging perches. About 4,357,500 acres ^h of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,420 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Black-tailed gnatcatcher (<i>Polioptila melanura</i>)	Nests in bushes mainly in wooded desert washes with dense mesquite, paloverde, ironwood, and acacia. Also occurs in desert scrub habitat. About 4,301,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,526 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Neotropical Migrants (Cont.)</i>					
Black-throated sparrow (<i>Amphispiza bilineata</i>)	Chaparral and desert scrub habitats with sparse to open stands of shrubs. Often in areas with scattered Joshua trees. Nests in thorny shrubs or cactus. About 4,283,900 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,080 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Brewer's sparrow (<i>Spizella breweri</i>)	Common in Mojave and Colorado deserts during winter. Occupies open desert scrub and cropland habitats. About 2,720,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat) during construction and operations	59,293 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Cactus wren (<i>Campylorhynchus brunneicapillus</i>)	Desert (especially areas with cholla cactus or yucca), mesquite, arid scrub, coastal sage scrub, and trees in towns in arid regions. Nests in <i>Opuntia</i> spp.; twiggy, thorny trees and shrubs; and sometimes in buildings. Nests may be used as winter roost. About 1,592,600 acres of potentially suitable habitat occurs within the SEZ region.	131 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) during construction and operations	29,182 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	2 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 174 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Common poorwill (<i>Phalaenoptilus nuttallii</i>)	Scrubby and brushy areas, prairie, desert, rocky canyons, open woodlands, and broken forests. Mostly in arid and semiarid habitats. Nests in open areas on a bare site. About 4,312,600 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,875 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Common raven (<i>Corvus corax</i>)	Occurs in most habitats. Trees and cliffs provide cover. Roosts primarily in trees. Nests on cliffs, bluffs, tall trees, or man-made structures. Forages in sparse, open terrain. About 4,988,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,991 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Costa's hummingbird (<i>Calypte costae</i>)	Desert and semidesert areas, arid brushy foothills, and chaparral. Main habitats are desert washes, edges of desert riparian and valley foothill riparian areas, coastal shrub, desert scrub, desert succulent shrub, lower-elevation chaparral, and palm oasis. Also in mountains, meadows, and gardens during migration and winter. Most common in canyons and washes when nesting. Nests are located in trees, shrubs, vines, or cacti. About 4,354,100 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,420 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. Avoid wash habitats. No other mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Gila woodpecker (<i>Melanerpes uropygialis</i>)	Prefers sparsely covered desert habitats containing large saguaro cacti. About 1,865,200 acres of potentially suitable habitat occurs within the SEZ region.	131 acres of potentially suitable habitat lost (0.007% of available potentially suitable habitat) during construction and operations	30,393 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Greater roadrunner (<i>Geococcyx californianus</i>)	Desert scrub, chaparral, edges of cultivated lands, and arid open areas with scattered brush. Fairly common in desert habitats. Requires thickets, large bushes, or small trees for shade, refuge, and roosting. Usually nests low in trees, shrubs, or clumps of cactus. Rarely nests on ground. About 4,785,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	97,755 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Horned lark (<i>Eremophila alpestris</i>)	Common to abundant resident in a variety of open habitats. Breeds in grasslands, sagebrush, semidesert shrublands, and alpine tundra. During migration and winter, inhabits the same habitats other than tundra, and occurs in agricultural areas. Usually occurs where plant density is low and there are exposed soils. About 3,139,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	68,924 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	19 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,653 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Neotropical Migrants</i> <i>(Cont.)</i>					
Ladder-backed woodpecker (<i>Picoides scalaris</i>)	Fairly common in Mojave and Colorado Deserts. Variety of habitats, including deserts, arid scrub, riparian woodlands, mesquite, scrub oak, pinyon-juniper woodlands. Digs nest hole in rotted stub or dead or dying branches of various trees. Also nests in saguaro, agave, yucca, fence posts, and utility poles. Nests on ledges; branches of trees, shrubs, and cactus; and holes in trees or walls. About 4,357,500 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,420 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Le Conte's thrasher (<i>Toxostoma leconteii</i>)	Open desert wash, alkali desert scrub, and desert succulent shrub habitats. Prefers to nest and forage in arroyos and washes lined with dense stands of creosotebush and salt bush. About 4,279,200 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,080 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Lesser nighthawk (<i>Chordeiles acutipennis</i>)	Open country, desert regions, scrub, savanna, and cultivated areas. Usually near water, including open marshes, salt ponds, large rivers, rice paddies, and beaches. Roosts on low perches or the ground. Nests in the open on bare sites. About 4,344,100 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,393 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Open country with scattered trees and shrubs, savanna, desert scrub, desert riparian, Joshua tree, and occasionally open woodland habitats. Perches on poles, wires, or fence posts (suitable hunting perches are important aspect of habitat). Nests in shrubs and small trees. About 4,819,300 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	99,228 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Lucy's warbler (<i>Vermivora luciae</i>)	Breeds most often in dense lowland riparian mesquite woodlands. Inhabits dry washes, riparian forests, and thorn forests during winter and migration. About 1,612,200 acres of potentially suitable habitat occurs within the SEZ region.	131 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) during construction and operations	30,171 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Phainopepla (<i>Phainopepla nitens</i>)	Common in Mojave and Colorado deserts. Desert scrub, mesquite, juniper and oak woodlands, tall brush, washes, riparian woodlands, and orchards. Nests in dense foliage of large shrubs or trees, sometimes in a clump of mistletoe. About 2,008,600 acres of potentially suitable habitat occurs in the SEZ region.	131 acres of potentially suitable habitat lost (0.007% of available potentially suitable habitat) during construction and operations	40,506 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Say's phoebe (<i>Sayornis saya</i>)	Arid open country, deserts, sagebrush plains, dry barren foothills, canyons, cliffs, ranches, and rural homes. Nests in cliff crevices, holes in banks, sheltered ledges, tree cavities, under bridges and roofs, and in mines. About 3,181,400 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	68,925 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	19 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,653 acres in area of indirect effects	Small overall impact. No mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Neotropical Migrants (Cont.)					
Verdin (<i>Auriparus flaviceps</i>)	Desert riparian, desert wash, desert scrub, and alkali desert scrub areas with large shrubs and small trees. Nests in shrubs, small trees, or cactus. About 4,685,700 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,442 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Birds of Prey					
American kestrel (<i>Falco sparverius</i>)	Occurs in most open habitats, in various shrub and early successional forest habitats, forest openings, and various ecotones. Perches on trees, snags, rocks, utility poles and wires, and fence posts. Uses cavities in trees, snags, rock areas, banks, and buildings for nesting and cover. About 2,282,000 acres of potentially suitable habitat occurs in the SEZ region.	131 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) during construction and operations	40,609 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Birds of Prey (Cont.)					
Golden eagle (<i>Aquila chrysaetos</i>)	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 2,044,500 acres of potentially suitable habitat occurs in the SEZ region.	131 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) during construction and operations	40,373 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.
Prairie falcon (<i>Falco mexicanus</i>)	Open habitats adjacent to cliffs or bluffs. Occurs mainly in desert grassland, chaparral, and creosotebush-bursage habitats. About 5,017,600 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	99,559 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Red-tailed hawk (<i>Buteo jamaicensis</i>)	Wide variety of habitats from deserts, mountains, and populated valleys. Open areas with scattered, elevated perch sites such as scrub desert, plains and montane grassland, agricultural fields, pastures urban parklands, broken coniferous forests, and deciduous woodland. Nests on cliff ledges or in tall trees. About 2,061,100 acres of potentially suitable habitat occurs in the SEZ region.	131 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) during construction and operations	38,844 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	1 acre of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 87 acres in area of indirect effects	Small overall impact.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Birds of Prey (Cont.)					
Turkey vulture (<i>Cathartes aura</i>)	Occurs in open stages of most habitats that provide adequate cliffs or large trees for nesting, roosting, and resting. Migrates and forages over most open habitats. Will roost communally in trees, exposed boulders, and occasionally transmission line support towers. About 3,190,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	70,915 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Upland Game Birds					
Gambel's quail (<i>Callipepla gambelii</i>)	Deserts, especially in areas with brushy or thorny growth, and adjacent cultivated areas. Usually occurs near water. Nests on the ground under cover of small trees, shrubs, and grass tufts. About 4,379,700 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,866 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Mourning dove (<i>Zenaidura macroura</i>)	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, deserts, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 5,010,300 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	87,839 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Upland Game Birds</i> (Cont.)					
White-winged dove (<i>Zenaidura macroura</i>)	Nests in low to medium height trees with dense foliage and fairly open ground cover. Feeds on wild seeds, grains, and fruit. About 4,362,900 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,839 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

- ^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- ^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 2,094 acres of direct effects within the SEZ was assumed.
- ^c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- ^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 2,094 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ.
- ^e For access road development, direct effects were estimated within a 3-mi (4.8-km) long, 60-ft (18-m) wide access road ROW from the SEZ to Old Highway 80. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.3.11.2-1 (Cont.)

- ^f Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^g Species-specific mitigation measures are suggested here, but final mitigation measures should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ^h To convert acres to km^2 , multiply by 0.004047.

Sources: Arizona Field Ornithologists (2010); CDFG (2008); CalPIF (2009); NatureServe (2010); USGS (2004, 2005, 2007).

1 the proposed Gillespie SEZ include the ash-throated flycatcher, black-tailed gnatcatcher, black-
2 throated sparrow, Brewer’s sparrow (*Spizella breweri*), cactus wren (*Campylorhynchus*
3 *brunneicapillus*), common poorwill (*Phalaenoptilus nuttallii*), common raven, Costa’s
4 hummingbird, Gila woodpecker, greater roadrunner (*Geococcyx californianus*), horned lark
5 (*Eremophila alpestris*), ladder-backed woodpecker, Le Conte’s thrasher, lesser nighthawk
6 (*Chordeiles acutipennis*), loggerhead shrike (*Lanius ludovicianus*), Lucy’s warbler, phainopepla,
7 Say’s phoebe (*Sayornis saya*), and verdin (Arizona Field Ornithologists 2010; CalPIF 2009;
8 USGS 2007).

11 **Birds of Prey**

13 Section 4.10.2.2.4 provides an overview of the birds of prey (raptors, owls, and vultures)
14 within the six-state solar study area. Raptor species that could occur within the proposed
15 Gillespie SEZ include the American kestrel (*Falco sparverius*), golden eagle (*Aquila*
16 *chrysaetos*), prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), and turkey
17 vulture (*Cathartes aura*) (Arizona Field Ornithologists 2010; USGS 2007). Several other special
18 status birds of prey are discussed in Section 8.3.12.

21 **Upland Game Birds**

23 Section 4.10.2.2.5 provides an overview of the upland game birds (primarily pheasants,
24 grouse, quail, and doves) that occur within the six-state solar study area. Upland game species
25 that could occur within the proposed Gillespie SEZ include Gambel’s quail (*Callipepla*
26 *gambelii*), mourning dove (*Zenaida macroura*), and white-winged dove (*Zenaida asiatica*)
27 (Arizona Field Ornithologists 2010; USGS 2007).

30 **8.3.11.2.2 Impacts**

32 The types of impacts that birds could incur from construction, operation, and
33 decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any
34 such impacts would be minimized through the implementation of required programmatic design
35 features described in Appendix A, Section A.2.2, and through any additional mitigation applied.
36 Section 8.3.11.2.3 identifies design features of particular relevance to the proposed Gillespie
37 SEZ.

39 The assessment of impacts on bird species is based on available information on the
40 presence of species in the affected area as presented in Section 8.3.11.2.1 following the analysis
41 approach described in Appendix M. Additional NEPA assessments and coordination with federal
42 or state natural resource agencies may be needed to address project-specific impacts more
43 thoroughly. These assessments and consultations could result in additional required actions to
44 avoid or mitigate impacts on birds (see Section 8.3.11.2.3).

1 In general, impacts on birds would result from habitat disturbance (i.e., habitat reduction,
2 fragmentation, and alteration), and from disturbance, injury, or mortality to individual birds.
3 Table 8.3.11.2-1 summarizes the potential impacts on representative bird species resulting from
4 solar energy development in the proposed Gillespie SEZ. On the basis of the impacts on birds
5 summarized in Table 8.3.11.2-1, direct impacts on representative bird species would be small for
6 all bird species (ranging from a high of 0.08% for Brewer's sparrow to a low of 0.007% for the
7 Gila woodpecker (Table 8.3.11.2-1). Larger areas of potentially suitable habitats for the bird
8 species occur within the area of potential indirect effects (e.g., up to 3.4% of available habitat for
9 the Brewer's sparrow). Indirect impacts on birds could result from surface water and sediment
10 runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and
11 harassment. These indirect impacts are expected to be negligible with implementation of
12 programmatic design features.

13
14 Decommissioning of facilities and reclamation of disturbed areas after operations cease
15 could result in short-term negative impacts on individuals and habitats adjacent to project areas,
16 but long-term benefits would accrue if suitable habitats were restored in previously disturbed
17 areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and
18 reclamation on wildlife. Of particular importance for bird species would be the restoration of
19 original ground surface contours, soils, and native plant communities associated with desert
20 scrub, playa, and wash habitats.

21 22 23 ***8.3.11.2.3 SEZ-Specific Design Features and Design Feature Effectiveness***

24
25 The successful implementation of programmatic design features presented in
26 Appendix A, Section A.2.2, would reduce the potential for effects on birds, especially for those
27 species that depend on habitat types that can be avoided (e.g., wash habitats). Indirect impacts
28 could be reduced to negligible levels by implementing programmatic design features, especially
29 those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust.
30 While SEZ-specific design features important for reducing impacts on birds are best established
31 when considering specific project details, the following design features can be identified at this
32 time:

- 33
34 • For solar energy projects within the SEZ, the requirements contained within
35 the 2010 Memorandum of Understanding between the BLM and USFWS to
36 promote the conservation of migratory birds will be followed.
- 37
38 • Take of golden eagles and other raptors should be avoided. Mitigation
39 regarding the golden eagle should be developed in consultation with the
40 USFWS and the Arizona Game and Fish Department. A permit may be
41 required under the Bald and Golden Eagle Protection Act.

42
43 If the SEZ-specific design features are implemented in addition to programmatic design
44 features, impacts on bird species could be reduced. However, as potentially suitable habitats for
45 most of the bird species occur throughout much of the SEZ, additional species-specific
46 mitigation of direct effects for those species would be difficult or infeasible.

1 **8.3.11.3 Mammals**

2
3
4 **8.3.11.3.1 Affected Environment**

5
6 This section addresses mammal species that are known to occur, or for which potentially
7 suitable habitat occurs, within the potentially affected area of the proposed Gillespie SEZ. The
8 list of mammal species potentially present in the project area was determined from Hoffmeister
9 (1986) and range maps and habitat information available from the SWReGAP (USGS 2007).
10 Land cover types suitable for each species were determined from SWReGAP (USGS 2004,
11 2005, 2007). See Appendix M for additional information on the approach used. About 45 species
12 of mammals have ranges that encompass the area of the proposed Gillespie SEZ
13 (Hoffmeister 1986; USGS 2007); however, suitable habitats for a number of these species are
14 limited or nonexistent within the SEZ (USGS 2007). Similar to the overview of mammals
15 provided for the six-state solar energy study area (Section 4.10.2.3), the following discussion for
16 the SEZ emphasizes big game and other mammal species that (1) have key habitats within or
17 near the SEZ, (2) are important to humans (e.g., big game, small game, and furbearer species),
18 and/or (3) are representative of other species that share important habitats.

19
20
21 **Big Game**

22
23 The big game species that could occur within the affected area of the proposed Gillespie
24 SEZ include cougar (*Puma concolor*) and mule deer (*Odocoileus hemionus*) (Hoffmeister 1986;
25 USGS 2007). Because of its special species status, the Nelson’s bighorn sheep is addressed in
26 Section 8.3.12.

27
28
29 **Other Mammals**

30
31 A number of small game and furbearer species occur within the area of the proposed
32 Gillespie SEZ. Species that could occur within the area of the proposed Gillespie SEZ include
33 the American badger (*Taxidea taxus*), black-tailed jackrabbit (*Lepus californicus*), bobcat (*Lynx*
34 *rufus*), coyote (*Canis latrans*, common), desert cottontail (*Sylvilagus audubonii*), gray fox
35 (*Urocyon cinereoargenteus*), javelina or spotted peccary (*Pecari tajacu*), kit fox (*Vulpes*
36 *macrotis*), ringtail (*Bassariscus astutus*), and striped skunk (*Mephitis mephitis*) (USGS 2007).

37
38 The nongame (small) mammal species generally include smaller mammals such as
39 rodents, bats, and shrews. Species for which potentially suitable habitat occurs within the SEZ
40 include the Arizona pocket mouse (*Perognathus amplus*), Botta’s pocket gopher (*Thomomys*
41 *bottae*), cactus mouse (*Peromyscus eremicus*), canyon mouse (*P. crinitis*), deer mouse
42 (*P. maniculatus*), desert pocket mouse (*Chaetodipus penicillatus*), desert shrew (*Notiosorex*
43 *crawfordi*), desert woodrat (*Neotoma lepida*), Merriam’s pocket mouse (*Dipodomys merriami*),
44 round-tailed ground squirrel (*Spermophilus tereticaudus*), southern grasshopper mouse
45 (*Onychomys torridus*), and white-tailed antelope squirrel (*Ammospermophilus leucurus*)
46 (Hoffmeister 1986; USGS 2007).

1 Bat species that may occur within the area of the SEZ include the big brown bat
2 (*Eptesicus fuscus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), California myotis (*Myotis*
3 *californicus*), silver-haired bat (*Lasionycteris noctivagans*), spotted bat (*Euderma maculatum*),
4 and western pipistrelle (*Pipistrellus hesperus*) (Hoffmeister 1986; USGS 2007). However, roost
5 sites for the bat species (e.g., caves, hollow trees, rock crevices, or buildings) would be limited to
6 absent within the SEZ. Several other special status bat species that could occur within the SEZ
7 area are addressed in Section 8.3.12.1.
8

9 Table 8.3.11.3-1 provides habitat information for representative mammal species that
10 could occur within the proposed Gillespie SEZ.
11

12 **8.3.11.3.2 Impacts**

13
14
15 The types of impacts that mammals could incur from construction, operation, and
16 decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any
17 such impacts would be minimized through the implementation of required programmatic design
18 features described in Appendix A, Section A.2.2, and through any additional mitigation applied.
19 Section 8.3.11.3.3, below, identifies design features of particular relevance to mammals for the
20 proposed Gillespie SEZ.
21

22 The assessment of impacts on mammal species is based on available information on the
23 presence of species in the affected area as presented in Section 8.3.11.3.1 following the analysis
24 approach described in Appendix M. Additional NEPA assessments and coordination with state
25 natural resource agencies may be needed to address project-specific impacts more thoroughly.
26 These assessments and consultations could result in additional required actions to avoid or
27 mitigate impacts on mammals (see Section 8.3.11.3.3).
28

29 Table 8.3.11.3-1 summarizes the potential impacts on select mammal species resulting
30 from solar energy development (with the inclusion of programmatic design features) in the
31 proposed Gillespie SEZ.
32

33 **Cougar**

34
35
36 Up to 2,094 acres (8.5 km²) of potentially suitable cougar habitat could be lost through
37 solar energy development within the proposed Gillespie SEZ. An additional 22 acres (0.09 km²)
38 could be lost by access road development. Together, these potential losses represent about 0.05%
39 of potentially suitable cougar habitat within the SEZ region. Over 88,000 acres (356 km²) of
40 potentially suitable cougar habitat occurs within the area of indirect effects for the SEZ and
41 access road. This is about 2.0% of potentially suitable cougar habitat within the SEZ region.
42 Overall, impacts on cougar from solar energy development in the SEZ would be small.
43
44

TABLE 8.3.11.3-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur in the Affected Area of the Proposed Gillespie SEZ

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Big Game Cougar (<i>Puma concolor</i>)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. About 4,357,400 acres ^h of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,420 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Mule deer (<i>Odocoileus hemionus</i>)	Most habitats, including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provides abundant browse and cover. About 4,780,600 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,916 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Small Game and Furbearers American badger (<i>Taxidea taxus</i>)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Digs burrows in friable soils. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 4,292,600 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,107 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Small Game and Furbearers (Cont.)					
Black-tailed jackrabbit (<i>Lepus californicus</i>)	Open plains, fields, and deserts with scattered thickets or patches of shrubs. Also open, early stages of forests and chaparral habitats. Rests during the day in shallow depressions, and uses shrubs for cover. About 3,186,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	70,210 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Bobcat (<i>Lynx rufus</i>)	Most habitats except subalpine coniferous forest and montane meadow grasslands. Most common in rocky country from deserts through ponderosa forests. About 2,788,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat) during construction and operations	59,849 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Coyote (<i>Canis latrans</i>)	All habitats at all elevations. Least common in dense coniferous forest. Where human control efforts occur, they are restricted to broken, rough country with abundant shrub cover and a good supply of rabbits or rodents. About 5,002,800 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,436 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
Small Game and Furbearers (Cont.)					
Desert cottontail (<i>Sylvilagus audubonii</i>)	Abundant to common in grasslands, open forests, and desert shrub habitats. Can occur in areas with minimal vegetation as long as adequate cover (e.g., rock piles, fallen logs, fence rows) is present. Thickets and patches of shrubs, vines, and brush also used as cover. About 4,728,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	97,468 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Gray fox (<i>Urocyon cinereoargenteus</i>)	Deserts, open forests, and brush. Prefers wooded areas, broken country, brushlands, and rocky areas. Tolerant of low levels of residential development. About 4,677,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	97,415 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Javelina (spotted peccary) (<i>Pecari tajacu</i>)	Often in thickets along creeks and washes. Beds in caves, mines, boulder fields, and dense stands of brush. May visit a water hole on a daily basis. About 4,448,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	90,289 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Small Game and Furbearers (Cont.)</i>					
Kit fox (<i>Vulpes macrotis</i>)	Desert and semidesert areas with relatively open vegetative cover and soft soils. Seeks shelter in underground burrows. About 4,327,700 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,864 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Ringtail (<i>Bassariscus astutus</i>)	Usually in rocky areas with cliffs or crevices for daytime shelter, desert scrub, chaparral, pine-oak and conifer woodlands. About 4,926,600 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,678 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Striped skunk (<i>Mephitis mephitis</i>)	Prefers semi-open country with woodland and meadows interspersed, brushy areas, bottomland woods. Frequently found in suburban areas. Dens often under rocks, log, or building. About 4,689,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,442 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals</i>					
Arizona pocket mouse (<i>Perognathus amplus</i>)	Various desert scrub habitats. Sleeps and rears young in underground burrows. About 4,285,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,552 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Big brown bat (<i>Eptesicus fuscus</i>)	Most habitats from lowland deserts to timberline meadows. Roosts in hollow trees, rock crevices, mines, tunnels, and buildings. About 4,900,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	97,218 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Botta's pocket gopher (<i>Thomomys bottae</i>)	Variety of habitats, including shortgrass plains, oak savanna, agricultural lands, and deserts. Burrows are more common in disturbed areas such as roadways and stream floodplains. About 4,267,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,551 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals</i>					
Brazilian free-tailed bat (<i>Tadarida brasiliensis</i>)	Cliffs, deserts, grasslands, old fields, savannas, shrublands, woodlands, and suburban/urban areas. Roosts in buildings, caves, and hollow trees. May roost in rock crevices, bridges, signs, or cliff swallow nests during migration. Large maternity colonies inhabit caves, buildings, culverts, and bridges. About 4,914,800 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,175 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Cactus mouse (<i>Peromyscus eremicus</i>)	Variety of areas, including desert scrub, semidesert chaparral, desert wash, semidesert grassland, and cliff and canyon habitats. About 4,376,300 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,866 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
California myotis (<i>Myotis californicus</i>)	Desertscrub, semidesert shrublands, lowland riparian, swamps, riparian suburban areas, plains grasslands, scrub-grasslands, woodlands, and forests. Roosts in caves, mine tunnels, hollow trees, and loose rocks. About 4,296,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,107 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals</i>					
Canyon mouse (<i>Peromyscus crinitus</i>)	Associated with rocky substrates in a variety of habitats, including desert scrub, sagebrush shrublands, woodlands, cliffs and canyons, and volcanic rock and cinder lands. Source of free water not required. About 4,333,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,876 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Deer mouse (<i>Peromyscus maniculatus</i>)	Tundra; alpine and subalpine grasslands; plains grasslands; open, sparsely vegetated deserts; warm temperate swamps and riparian forests; and Sonoran desert scrub habitats. About 4,672,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	97,913 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Desert pocket mouse (<i>Chaetodipus penicillatus</i>)	Sparsely vegetated sandy deserts. Prefers rock-free bottomland soils along rivers and streams. Sleeps and rears young in underground burrows. About 4,336,200 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,554 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals (Cont.)</i>					
Desert shrew (<i>Notiosorex crawfordi</i>)	Usually in arid areas with adequate cover such as semiarid grasslands, shortgrass plains, desert scrub, chaparral slopes, shortgrass plains, oak savannas and woodlands, and alluvial fans. About 4,769,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	99,201 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Desert woodrat (<i>Neotoma lepida</i>)	Sagebrush scrub; chaparral; deserts and rocky slopes with scattered cactus, yucca, pine-juniper, or other low vegetation; creosotebush desert; Joshua tree woodlands; scrub oak woodlands, pinyon-juniper woodlands; and riparian zones. Most abundant in rocky areas with Joshua trees. Dens built of debris on ground, among cacti or yucca, along cliffs, among rocks, or occasionally in trees. About 4,350,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,405 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals (Cont.)</i>					
Merriam's kangaroo rat (<i>Dipodomys merriami</i>)	Plains grasslands, scrub-grasslands, desertscrub, shortgrass plains, oak and juniper savannahs, mesquite dunes, and creosote flats. About 4,344,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,393 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Round-tailed ground squirrel (<i>Spermophilus tereticaudus</i>)	Low flat areas with desert shrubs and usually with sandy soils. Also in areas with coarse hard-packed sand and gravel, alkali sinks, and creosotebush communities. Burrows usually at base of shrubs. Avoids rocky hills. About 4,375,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,421 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Silver-haired bat (<i>Lasiorycteris noctivagans</i>)	Urban areas, chaparral, alpine and subalpine grasslands, forests, scrub-grassland, oak savannah, and desertscrub habitats. Roosts under bark, and in hollow trees, caves and mines. Forages over clearings and open water. About 2,959,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	59,610 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals (Cont.)</i>					
Southern grasshopper mouse (<i>Onychomys torridus</i>)	Low, arid, shrub and semiscrub vegetation of deserts. About 4,358,500 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,337 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Spotted bat (<i>Euderma maculatum</i>)	Various habitats from desert to montane coniferous forests, mostly in open or scrub areas. Roosts in caves and cracks and crevices in cliffs and canyons. About 2,777,500 acres of potentially suitable habitat occurs within the SEZ region	2,094 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat) during construction and operations	60,254 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Western pipistrelle (<i>Parastrellus hesperus</i>)	Deserts and lowlands, desert mountain ranges, desert scrub flats, and rocky canyons. Roosts mostly in rock crevices, sometimes mines and caves, and rarely in buildings. Suitable roosts occur in rocky canyons and cliffs. Most abundant bat in desert regions. About 4,503,800 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,798 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat ^a	Maximum Area of Potential Habitat Affected ^b			Overall Impact Magnitude ^f and Species-Specific Mitigation ^g
		Within SEZ (Direct Effects) ^c	Outside SEZ (Indirect Effects) ^d	Within Access Road Corridor (Indirect and Direct Effects) ^e	
<i>Nongame (small)</i>					
<i>Mammals (Cont.)</i>					
White-tailed antelope squirrel (<i>Ammospermophilus leucurus</i>)	Low deserts, semidesert and montane shrublands, plateaus, and foothills in areas with sparse vegetation and hard gravelly surfaces. Spends its nights and other periods of inactivity in underground burrows. About 4,260,400 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,536 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

- ^a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- ^b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 2,094 acres of direct effects within the SEZ was assumed.
- ^c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- ^d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 2,094 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.
- ^e For access road development, direct effects were estimated within a 3-mi (4.8-km) long, 60-ft (18-m) wide access road ROW from the SEZ to Old Highway 80. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.3.11.3-1 (Cont.)

-
- ^f Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^g Species-specific mitigation measures are suggested here, but final mitigation measures should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ^h To convert acres to km^2 , multiply by 0.004047.

Sources: CDFG (2008); Hoffmeister (1986); NatureServe (2010); USGS (2004, 2005, 2007).

1 **Mule Deer**

2
3 Up to 2,094 acres (8.5 km²) of potentially suitable mule deer habitat could be lost
4 through solar energy development within the proposed Gillespie SEZ. An additional 22 acres
5 (0.09 km²) could be lost by access road development. Together, these potential losses represent
6 about 0.04% of potentially suitable mule deer habitat within the SEZ region. About 99,000 acres
7 (400 km²) of potentially suitable mule deer habitat occurs within the area of indirect effects for
8 the SEZ and access road. This is about 2.1% of potentially suitable mule deer habitat within the
9 SEZ region. Overall, impacts on mule deer from solar energy development in the SEZ would be
10 small.

11
12
13 **Other Mammals**

14
15 Direct impacts on all other representative mammal species from solar energy
16 development within the proposed Gillespie SEZ would be small (Table 8.3.11.3-1). For all of
17 these species, up to 2,094 acres (8.5 km²) (0.04 to 0.08%) of potentially suitable habitat would
18 be lost. Direct impacts on these species from access road development would range from 20 to
19 22 acres (0.8 to 0.9 km²) (Table 8.3.11.3-1). Loss of potential habitat to access road development
20 would be <0.001% of potentially suitable habitat within the SEZ region for any of these species.
21 Larger areas of potentially suitable habitats for these mammal species occur within the area of
22 potential indirect effects (i.e., from 1.9 to 2.2% of available habitat) (Table 8.3.11.3-1).

23
24
25 **Summary**

26
27 Overall, impacts on mammal species would be small (Table 8.3.11.3-1). In addition to
28 habitat loss, other direct impacts on mammals could result from collision with vehicles and
29 infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and
30 sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental
31 spills, and harassment. These indirect impacts are expected to be negligible with implementation
32 of programmatic design features.

33
34 Decommissioning of facilities and reclamation of disturbed areas after operations cease
35 could result in short-term adverse impacts on individuals and habitats adjacent to project areas,
36 but long-term benefits would accrue if suitable habitats were restored in previously disturbed
37 areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and
38 reclamation on wildlife. Of particular importance for mammal species would be the restoration
39 of original ground surface contours, soils, and native plant communities associated with desert
40 scrub, playa, and wash habitats.

41
42
43 **8.3.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness**

44
45 The implementation of required programmatic design features described in Appendix A,
46 Section A.2.2, would reduce the potential for effects on mammals. Specifics of mitigation

1 measures that are particularly important to reduce impacts on mammals are best established
2 when considering project-specific details. However, the following SEZ-specific design feature
3 can be identified at this time:

- 4
- 5 • The fencing around solar energy projects should not block the free movement
6 of mammals, particularly big game species.
- 7

8 If this SEZ-specific design feature is implemented in addition to programmatic design
9 features, impacts on mammals could be reduced. However, potentially suitable habitats for a
10 number of the mammal species occur throughout much of the SEZ; therefore, species-specific
11 mitigation of direct effects for those species would be difficult or infeasible.

12

13

14 **8.3.11.4 Aquatic Biota**

15

16

17 ***8.3.11.4.1 Affected Environment***

18

19 The proposed Gillespie SEZ is located in a semiarid desert valley where surface waters
20 are typically limited to intermittent washes that only contain water for short periods during or
21 following precipitation. No perennial or intermittent streams or water bodies are present in the
22 proposed Gillespie SEZ or within the area of direct effects associated with the presumed new
23 access road. Ephemeral streams cross the SEZ, but these drainages only contain water following
24 rainfall and typically do not support wetland or riparian habitats. Aquatic habitat and
25 communities are not likely to be present in the ephemeral drainages, although opportunistic
26 crustaceans and aquatic insect larvae adapted to desert conditions may be present even under dry
27 conditions (Levick et al. 2008). However, more detailed site survey data is needed to
28 characterize the aquatic biota, if present, in the proposed Gillespie SEZ. The NWI has only
29 partially mapped the Gillespie SEZ. A riverine wetland is located just inside the southeast corner
30 of the SEZ (USFWS 2009a). Wetlands are described in detail in Section 8.3.10.1.

31

32 There are no perennial or intermittent water bodies present within the area of indirect
33 effects associated with the SEZ or the presumed road corridor. Several perennial and intermittent
34 streams are present within the area of indirect effects associated with the proposed Gillespie
35 Wash SEZ, including 5 mi (8 km) of the perennial Gila River, 2 mi (3 km) of Gila Bend Canal,
36 and 21 mi (34 km) of intermittent washes. Within the area of indirect effects associated with the
37 presumed new access road there are 0.31 mi (0.5 km) of the perennial Gila River, 0.73 mi (1 km)
38 of the intermittent Centennial Wash, 0.09 mi (0.1 km) of intermittent portions of the Gila River,
39 and 0.05 mi (0.1 km) of the Gila Bend Canal. The intermittent Centennial Wash carries
40 significant flows to the Gila River (Section 8.3.9.1.1). Although portions of the Gila River near
41 the SEZ are perennial (primarily due to wastewater treatment effluent released upstream of the
42 area), most of the Gila River below Phoenix is intermittent because of water withdrawals for
43 municipal and agricultural uses (Section 8.3.9.1.1). The Gila River becomes perennial again near
44 its confluence with the Colorado River more than 90 mi (145 km) from the SEZ.

1 The intermittent streams present in the area of indirect effects may contain aquatic habitat
2 and aquatic species when sufficient water is present. For example, one study of intermittent
3 desert streams and washes in the western United States indicated that although communities
4 consisted primarily of terrestrial invertebrates, they also contained aquatic taxa from the Insecta,
5 Hydracarina, Crustacea, Oligochaeta, Hirudinea, and Gastropoda groups, as well as tolerant
6 native and introduced fish species (URS Corporation 2006). Biota in ephemeral or intermittent
7 streams may also contribute to populations in perennial reaches by dispersing downstream during
8 wet periods with increased hydrologic connectivity (Levick et al. 2008). Fish collections in the
9 Salt River near Phoenix indicated Sonora sucker (*Catostomus insignis*), largemouth bass
10 (*Micropterus salmoides*), bluegill sunfish (*Lepomis macrochirus*), and tilapia (family Cichlidae)
11 were consistently abundant species. Other species were of sporadic occurrence and generally
12 were uncommon to rare (Marsh and Kesner 2006).

13
14 Outside of the indirect effects area, but within 50 mi (80 km) of the proposed Gillespie
15 SEZ, are approximately 47 mi (76 km) of perennial streams, 745 mi (1,199 km) of intermittent
16 streams, and 153 mi (246 km) of canals. No water bodies are present within 50 mi (80 km) of
17 the proposed Gillespie SEZ. Intermittent streams are the only surface water feature in the area
18 of direct and indirect effects and their area represents approximately 3% of the total amount of
19 intermittent stream present in the 50-mi (80 km) SEZ region.

20 21 22 **8.3.11.4.2 Impacts**

23
24 Because surface water habitats are a unique feature in the arid landscape in the vicinity of
25 the proposed Gillespie SEZ, the maintenance and protection of such habitats may be important to
26 the survival of aquatic and terrestrial organisms. The types of impacts that aquatic habitats and
27 biota could incur from the development of utility-scale solar energy facilities are described in
28 detail in Section 5.10.3. Aquatic habitats present on or near the locations selected for
29 construction of solar energy facilities could be affected in a number of ways, including (1) direct
30 disturbance, (2) deposition of sediments, (3) changes in water quantity, and (4) degradation of
31 water quality.

32
33 As mentioned above, no permanent water bodies, streams, or wetlands are present within
34 the boundaries of either the proposed Gillespie SEZ or the presumed new access road corridor,
35 and consequently direct impacts on aquatic habitats from solar energy development are unlikely.
36 In addition, no high-quality perennial surface water features are located in the area of indirect
37 effects. Intermittent and ephemeral streams are present in the area of indirect effects associated
38 with the SEZ. The Gila River and the Centennial Wash may contain aquatic habitat and biota and
39 the Gila River flows into perennial surface waters (Colorado River). Disturbance of land areas
40 within the SEZ for solar energy facilities could increase the transport of soil into aquatic habitat
41 within the Gila River via water and airborne pathways, adversely affecting aquatic habitat locally
42 and downstream. However, more detailed site surveys for biota in ephemeral and intermittent
43 surface waters would be necessary to determine whether solar energy development activities
44 would result in direct or indirect impacts on aquatic biota. The introduction of waterborne
45 sediments to Centennial Wash and the Gila River could be minimized by using common

1 mitigation measures, such as settling basins and silt fences, or directing water draining from the
2 developed areas away from streams.

3
4 In arid environments, reductions in the quantity of water in aquatic habitats are of
5 particular concern. Water quantity in aquatic habitats could also be affected if significant
6 amounts of surface water or groundwater are utilized for power plant cooling water, for washing
7 mirrors, or for other needs. The greatest need for water would occur if technologies employing
8 wet cooling, such as parabolic trough or power tower, were developed at the site. The associated
9 impacts would ultimately depend on the water source used (including groundwater from aquifers
10 at various depths). There are no surface water sources on the proposed Gillespie SEZ that could
11 be used to supply water needs. Water demands during normal operations would most likely be
12 met by withdrawing groundwater from wells constructed on-site. Groundwater outflows are
13 primarily as surface water discharge in the Gila River (Section 8.3.9.1.2). Consequently,
14 groundwater withdrawals could reduce water supporting aquatic organisms in the Gila River
15 (Section 8.3.9.2.4) and other surface water features outside of the SEZ and area of indirect
16 effects, and, as a consequence, potentially reduce habitat size and connectivity, and create more
17 adverse environmental conditions for aquatic organisms in those habitats. Additional details
18 regarding the volumes of water required and the types of organisms present in potentially
19 affected water bodies would be required in order to further evaluate the potential for impacts
20 from water withdrawals.

21
22 As described in Section 5.10.2.4, water quality in aquatic habitats could be affected by
23 the introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during site
24 characterization, construction, operation, or decommissioning/reclamation of a solar energy
25 facility. This is particularly true of ground disturbance activities near the Gila River and
26 Centennial Wash associated with the presumed new access road.

27 28 29 ***8.3.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness***

30
31 No SEZ-specific design features have been identified at this time. If programmatic
32 project design features described in Appendix A, Section A.2.2 are implemented and if the
33 utilization of water from groundwater or surface water sources is adequately controlled to
34 maintain sufficient water levels in aquatic habitats, the potential impacts on aquatic biota and
35 habitats from solar energy development at the proposed Gillespie SEZ would be negligible.
36

8.3.12 Special Status Species (Threatened, Endangered, Sensitive, and Rare)

This section addresses special status species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Gillespie SEZ. Special status species include the following types of species⁴:

- Species listed as threatened or endangered under the ESA;
- Species that are proposed for listing, under review, or are candidates for listing under the ESA;
- Species that are listed by the BLM as sensitive;
- Species that are listed by the State of Arizona⁵; and
- Species that have been ranked by the State of Arizona as S1 or S2, or species of concern by the USFWS; hereafter referred to as “rare” species.

Special status species known to occur within 50-mi (80 km) of the Gillespie SEZ center (i.e., the SEZ region) were determined from natural heritage records available through NatureServe Explorer (NatureServe 2010), information provided by the ANHP (Schwartz 2009; ANHP 2010), SWReGAP (USGS 2004, 2005, 2007), and the USFWS Environmental Conservation Online System (ECOS) (USFWS 2010a). Information reviewed consisted of county-level occurrences as determined from Nature Serve, quad-level occurrences provided by the ANHP, as well as modeled land cover types and predicted suitable habitats for the species within the 50 mi (80 km) region as determined from SWReGAP. The 50-mi (80-km) SEZ region intersects La Paz, Maricopa, Pinal, and Yuma Counties in Arizona. However, the SEZ and affected area occur only in Maricopa County. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

8.3.12.1 Affected Environment

The affected area considered in the assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur). For the Gillespie SEZ, the area of direct effects included the SEZ and the area within the assumed access road corridor where ground disturbing activities are assumed to occur. Due to the proximity of existing infrastructure, the impacts of construction and operation of transmission lines outside of the SEZ are not assessed, assuming that the existing transmission infrastructure might be used to

⁴ See Section 4.6.4 for definitions of these species categories. Note that some of the categories of species included here do not fit BLM’s definition of special status species as defined in BLM Manual 6840 (BLM 2008a). These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

⁵ State-listed species for the state of Arizona are those plants protected under the Arizona Native Plant Law or wildlife listed by the Arizona Game and Fish Department as Wildlife of Special Concern (WSC).

1 connect some new solar facilities to load centers, and that additional project-specific analysis
2 would be conducted for new transmission construction or line upgrades (refer to Section 8.3.1.2
3 for development assumptions). The area of indirect effects was defined as the area within 5 mi
4 [8 km] of the SEZ boundary and within the assumed access road corridor where ground-
5 disturbing activities would not occur but that could be indirectly affected by activities in the area
6 of direct effect. Indirect effects considered in the assessment included effects from groundwater
7 withdrawals, surface runoff, dust, noise, lighting, and accidental spills from the SEZ, but do not
8 include ground disturbing activities. For the most part, the potential magnitude of indirect effects
9 would decrease with increasing distance away from the SEZ. This area of indirect effect was
10 identified on the basis of professional judgment and was considered sufficiently large to bound
11 the area that would potentially be subject to indirect effects. The affected area includes both the
12 direct and indirect effects areas.

13
14 The primary land cover habitat type within the affected area is Sonora-Mojave creosote
15 desert scrub (see Section 8.3.10). Potentially unique habitats in the affected area in which special
16 status species may reside include desert washes and associated riparian habitats. There is also
17 approximately 10,000 acres (40 km²) of agricultural land cover types in the affected area. There
18 are no aquatic habitats known to occur on the SEZ or anywhere within the area of direct effects.
19 Aquatic habitats known to occur within the area of indirect effects are the Hassayampa River,
20 Gila River, Gila Bend Canal, and Centennial Wash (Figure 8.3.12.1-1).

21
22 In their scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS
23 expressed concern that riparian habitat for the southwestern willow flycatcher, western yellow-
24 billed cuckoo, and Yuma clapper rail along the Gila River may be indirectly affected by project
25 development on the SEZ. The southwestern willow flycatcher and Yuma clapper rail are listed
26 as endangered under the ESA; the western yellow-billed cuckoo is a candidate for listing under
27 the ESA. Riparian habitats for these species along the Gila River may be indirectly affected by
28 groundwater withdrawals from the lower Hassayampa River Groundwater Basin to serve solar
29 energy development on the SEZ. Although a portion of the Gila River flows through the area of
30 indirect effects, some additional areas occur downstream of the SEZ and outside of the area of
31 indirect effects as defined above. These areas are included in our evaluation because of the
32 possible effect of groundwater withdrawals.

33
34 All special status species that are known to occur within the Gillespie SEZ region
35 (i.e., within 50 mi [80 km] of the center of the SEZ) are listed, with their status, nearest recorded
36 occurrence, and habitats in Appendix J. Of these species, there are 29 that could be affected
37 by solar energy development on the SEZ, based on recorded occurrences or the presence of
38 potentially suitable habitat in the area. These species, their status, and their habitats are presented
39 in Table 8.3.12.1-1. For many of the species listed in the table (especially plants), their predicted
40 potential occurrence in the affected area is based only on a general correspondence between
41 mapped SWReGAP land cover types and descriptions of species habitat preferences. This overall
42 approach to identifying species in the affected area probably overestimates the number of species
43 that actually occur in the affected area. For many of the species identified as having potentially
44 suitable habitat in the affected area, the nearest known occurrence is over 20 mi (32 km) away
45 from the SEZ.

1 Based on ANHP records, quad-level occurrences for the following 10 special status
2 species intersect the affected area of the Gillespie SEZ: California barrel cactus, straw-top cholla,
3 roundtail chub, lowland leopard frog, Sonoran desert tortoise, southwestern willow flycatcher,
4 western yellow-billed cuckoo, Yuma clapper rail, California leaf-nosed bat, and cave myotis.
5 These species are indicated in bold text in Table 8.3.12.1-1.
6
7

8 ***8.3.12.1.1 Species Listed under the Endangered Species Act That Could Occur*** 9 ***in the Affected Area*** 10

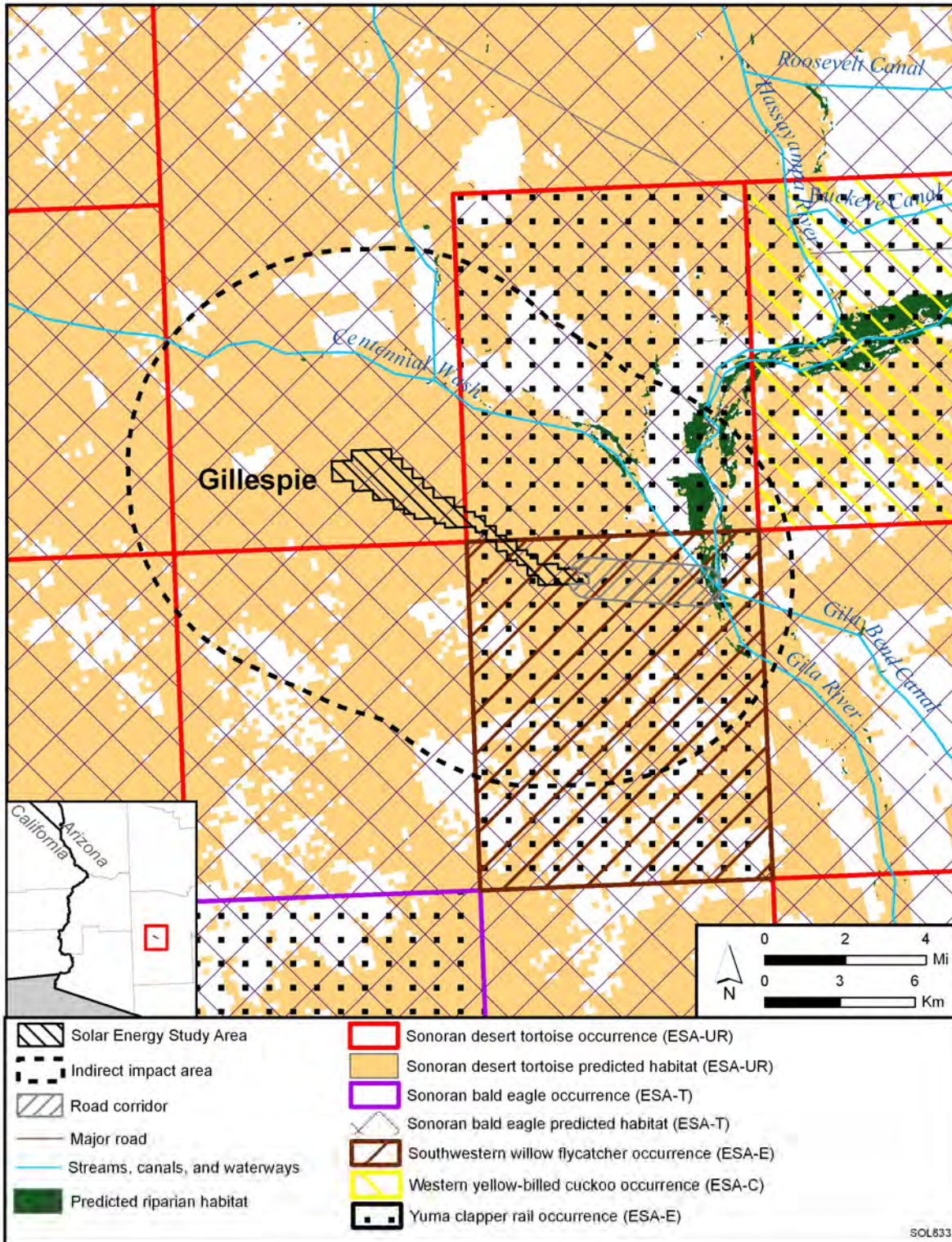
11 In scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS expressed
12 concern for impacts of project development within the SEZ on habitat for the southwestern
13 willow flycatcher and Yuma clapper rail, species listed as endangered under the ESA. In addition
14 to these species, the Sonoran population of the bald eagle—listed as threatened under the ESA—
15 may also occur in the affected area of the Gillespie SEZ. Of these species, the southwestern
16 willow flycatcher and Yuma clapper rail have quad-level occurrences within the affected area in
17 riparian habitats along the Gila River, about 5 mi (8 km) east of the SEZ. These three species are
18 discussed below and information on their habitat is presented in Table 8.3.12.1-1; additional
19 basic information on life history, habitat needs, and threats to populations of these species is
20 provided in Appendix J.
21
22

23 **Sonoran Bald Eagle** 24

25 The Sonoran population of the bald eagle is currently listed as threatened under the ESA,
26 although recent findings by the USFWS have indicated that listing for this species is not
27 warranted (USFWS 2010b). According to ANHP records, the species is known to occur along
28 the Gila River, approximately 15 mi (24 km) south of the SEZ (Figure 8.3.12.1-1). This species
29 is primarily known to occur in riparian habitats associated with larger permanent water bodies
30 such as lakes, rivers, and reservoirs. However, it may occasionally forage in arid shrubland
31 habitats. According to the SWReGAP habitat suitability model, approximately 98,500 acres
32 (399 km²) of potentially suitable winter foraging habitat for the Sonoran population of the bald
33 eagle may occur in the affected area of the Gillespie SEZ (Table 8.3.12.1-1). Because there is
34 relatively little aquatic and riparian habitat (2,100 acres [8 km²]) in the affected area, most of
35 this potentially suitable foraging habitat is represented by shrubland. Critical habitat has not
36 been designated for this species.
37
38

39 **Southwestern Willow Flycatcher** 40

41 The southwestern willow flycatcher is a small neotropical migrant bird that inhabits
42 riparian shrublands, woodlands, and thickets in the southwestern United States. Although the
43 SWReGAP habitat suitability model for the southwestern willow flycatcher does not identify
44 any suitable habitat for this species within the affected area, quad-level occurrences for this
45 species intersect the affected area, and these occurrences are presumably from riparian habitats
46 along the Hassayampa and Gila Rivers east of the SEZ within the area of indirect effects and



1
 2 **FIGURE 8.3.12.1-1 Known or Potential Occurrences of Species Listed as Endangered or**
 3 **Threatened under the ESA, Candidate for Listing under the ESA, or Species under Review**
 4 **for ESA Listing in the Affected Area of the Proposed Gillespie SEZ (Sources: Schwartz 2009;**
 5 **USFWS 2010b; USGS 2007)**

TABLE 8.3.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Gillespie SEZ

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Plants</i>							
Arid tansy-aster	<i>Machaeranthera arida</i>	AZ-S1	Low sand dunes, alkaline flats, riverbanks, and sandy roadsides. Nearest recorded quad-level occurrences are near Phoenix, approximately 30 mi ⁱ southeast of the SEZ. About 293,000 acres ^j of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,264 acres of potentially suitable riparian habitat (0.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian habitat in the access road corridor could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Note that these same potential mitigations apply to all special status plant species that could be found only in desert riparian areas in the area of direct effects.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Plants (Cont.)</i>							
California barrel cactus^k	<i>Ferocactus cylindraceus</i> var. <i>cylindraceus</i>	AZ-SR	Gravelly or rocky hillsides, canyon walls, alluvial fans, and desert washes at elevations between 200 and 2,900 ft. ^l Quad-level occurrences intersect the affected area. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable mitigations.
California snakewood	<i>Colubrina californica</i>	AZ-S2	Sandy desert washes, steep gullies, and rocky or gravelly slopes at elevations below 3,000 ft. Nearest quad-level occurrence is 7 mi south of the SEZ. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable mitigations.
Hohokam agave	<i>Agave murpheyi</i>	BLM-S; AZ-HS; FWS-SC; AZ-S2	Endemic to Arizona and Sonora, Mexico on benches or alluvial terraces on gentle bajada slopes above major drainages in desert scrub communities. Elevation ranges between 1,300 and 3,200 ft. Nearest recorded quad-level occurrences are approximately 45 mi north of the SEZ. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable potential mitigations.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Plants (Cont.)</i>							
Straw-top cholla	<i>Opuntia echinocarpa</i>	AZ-SR	Sandy or gravelly soil of benches, slopes, mesas, flats, and washes at elevations between 1,000 and 6,700 ft. Quad-level occurrences intersect the affected area. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable potential mitigations.
Tumamoc globeberry	<i>Tumamoca macdougalii</i>	BLM-S; AZ-SR	Endemic to southern Arizona and northern Mexico in xeric situations, in shady areas of nurse plants along gullies and sandy washes at elevations below 3,000 ft. Nearest quad-level occurrence is approximately 35 mi southeast of the SEZ. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable potential mitigations.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Invertebrates</i> Maricopa tiger beetle	<i>Cicindela oregona maricopa</i>	FWS-SC	Known primarily from Maricopa County, Arizona in sandy riparian areas such as stream banks and sand bars. Nearest recorded quad-level occurrences are approximately 45 mi north of the SEZ. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian habitat in the access road corridor could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Fish</i> Roundtail chub	<i>Gila robusta</i>	BLM-S; AZ-WSC; FWS-SC; AZ-S2	Larger tributaries in the Colorado Basin, from Wyoming south to Arizona and New Mexico; cool to warm water streams and rivers consisting of pools adjacent to riffles and runs and with boulders, tree roots, submerged trees and branches, and undercut cliff walls. Historic quad-level occurrence intersects the affected area from the Gila River, within 5 mi east of the SEZ. The species is currently not known to occur in the affected area. About 300 mi of potentially suitable habitat within the Gila and Hassayampa Rivers occurs within the SEZ region.	0 mi	0 mi	9 mi of potentially suitable aquatic habitat within the Gila River (3.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable historic habitat for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals for solar energy development on the SEZ could reduce impacts on this species to negligible levels.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Amphibians</i>							
Arizona toad	<i>Bufo microscaphus</i>	FWS-SC	Woodlands and low-elevation riparian habitats in association with permanent or semi-permanent water bodies; in and along streams, ditches, flooded fields, irrigated croplands, and permanent reservoirs. Nearest recorded quad-level occurrence is from the Hassayampa River, approximately 50 mi north of the SEZ. About 3,950 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	655 acres of potentially suitable habitat (16.7% of available potentially suitable habitat)	Small to large overall impact; no direct impact. Potentially suitable habitats for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals for solar energy development on the SEZ could reduce impacts on this species to negligible levels.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Amphibians (Cont.)</i>							
Lowland leopard frog	<i>Lithobates yavapaiensis</i>	BLM-S; AZ-WSC; FWS-SC	Aquatic systems in desert grasslands, pinyon-juniper woodlands, and agricultural areas, including rivers, streams, beaver ponds, springs, earthen cattle tanks, livestock guzzlers, canals, and irrigation sloughs. Quad-level occurrences intersect the affected area. About 246,500 acres of potentially suitable habitat occurs within the SEZ region.	288 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	0 acres	7,480 acres of potentially suitable habitat (3.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable habitats for this species may be directly affected on the SEZ or indirectly affected from groundwater withdrawals. Avoiding or minimizing disturbance to suitable habitats and avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species to negligible levels. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Reptiles Desert tortoise (Sonoran population)	<i>Gopherus agassizii</i>	ESA-UR; BLM-S; AZ-WSC	Mojave and Sonoran Deserts in desert creosotebush communities on firm soils for digging burrows, along riverbanks, washes, canyon bottoms, creosote flats, and desert oases. Quad-level occurrences intersect the affected area. About 3,750,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	76,700 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in coordination with the USFWS and AZGFD.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Reptiles (Cont.)							
Gila monster	<i>Heloderma suspectum</i>	FWS-SC	Mojave and Sonoran Deserts in areas of rocky, deeply incised topography and riparian habitat, desert scrub, thorn scrub, desert riparian, oak woodland, and semi-desert grassland. Lower mountain slopes, rocky bajadas, canyon bottoms, and arroyos at elevations below 3,950 ft. Nearest quad-level occurrence is 6 mi north of the SEZ. About 4,322,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	87,600 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mexican rosy boa	<i>Charina trivirgata trivirgata</i>	BLM-S; FWS-SC; AZ-S1	Sonoran Desert near rocky hillsides and rock outcroppings. Nearest quad-level occurrence is approximately 20 mi southeast of the SEZ. About 3,800,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	84,700 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Reptiles (Cont.)							
Tucson shovel-nosed snake	<i>Chionactis occipitalis klauberi</i>	ESA-C; BLM-S; AZ-S1	Endemic to Arizona from Pima, Pinal, and Maricopa Counties in creosote-mesquite floodplain habitats with soft sandy loam soils and sparse gravel. Nearest quad-level occurrence is approximately 20 mi southeast of the SEZ. About 1,436,500 acres of potentially suitable habitat occurs within the SEZ region.	384 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	7 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	31,400 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in coordination with the USFWS and AZGFD

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds							
Bald eagle (Sonoran population)	<i>Haliaeetus leucocephalus</i>	ESA-T; BLM-S; AZ-WSC; AZ-S2	Winter resident in the SEZ region, most commonly along large bodies of water where fish and waterfowl prey are available. May occasionally forage in arid shrubland habitats. Nearest quad-level occurrence is from the Gila River, approximately 15 mi south of the SEZ. About 4,775,500 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	22 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	98,500 acres of potentially suitable foraging habitat (2.1% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Cattle egret	<i>Bubulcus ibis</i>	AZ-S1	Winter resident and migrant in the SEZ region. Herbaceous, scrub-shrub, forested, and riparian wetlands as well as croplands and herbaceous grasslands, wet pastureland, marshes, fresh and brackish situations, dry fields, agricultural areas, and garbage dumps. Nearest quad-level occurrence is from Painted Rock Reservoir, approximately 11 mi south of the SEZ. About 43,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,780 acres of potentially suitable aquatic or riparian habitat (4.1% of available potentially suitable habitat)	Small to large overall impact; no direct impact. Potentially suitable aquatic or riparian habitats for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Birds (Cont.)</i>							
Ferruginous hawk	<i>Buteo regalis</i>	BLM-S; AZ-WSC; FWS-SC; AZ-S2	Winter resident in the SEZ region. Grasslands, sagebrush and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands. Nests in tall trees or on rock outcrops along cliff faces. Known to occur in Maricopa County, Arizona. About 395,000 acres of potentially suitable foraging habitat occurs within the SEZ region.	0 acres	0 acres	10,600 acres of potentially suitable foraging habitat (2.7% of available potentially suitable habitat)	Small overall impact on foraging habitat only; no direct impact. No species-specific mitigation is warranted.
Great egret	<i>Ardea alba</i>	BLM-S; AZ-WSC; AZ-S1	Year-round resident in the lower Colorado River Valley in open water areas such as marshes, estuaries, lagoons, lakes, ponds, rivers and flooded fields. Nearest quad-level occurrence is from Painted Rock Reservoir, approximately 11 mi south of the SEZ. About 28,750 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,000 acres of potentially suitable aquatic or riparian habitat (3.5% of available potentially suitable habitat)	Small to large overall impact; no direct impact. Potentially suitable aquatic or riparian habitats for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds (Cont.)							
Long-eared owl	<i>Asio otus</i>	AZ-S2	Winter resident in the SEZ region. Deciduous and evergreen forests, orchards, wooded parks, farm woodlots, riparian areas, and desert oases. Nests in trees in old nests of other birds or squirrels; sometimes nests in tree cavities. Nearest quad-level occurrence is approximately 30 mi west of the SEZ. About 4,733,750 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	98,700 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Snowy egret	<i>Egretta thula</i>	BLM-S; AZ-WSC; AZ-S1	Year-round resident in the lower Colorado River Valley in open water areas such as marshes, estuaries, lagoons, lakes, ponds, rivers and flooded fields. Nearest quad-level occurrence is from Painted Rock Reservoir, approximately 11 mi south of the SEZ. About 675,200 acres of potentially suitable habitat occurs within the SEZ region. The species is expected to occur as a transient only on the SEZ.	425 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	15,000 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable aquatic or riparian habitats for this species may be directly affected on the SEZ and access road corridor or may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or minimizing disturbance to suitable habitats and avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Birds (Cont.)</i>							
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	ESA-E; AZ-WSC; AZ-S1	Riparian shrublands and woodlands, thickets, scrubby and brushy areas, open second growth, swamps, and open woodlands. Quad-level occurrences intersect the affected area. About 50,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (4.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable riparian habitats for this species may be directly affected in the access road corridor or may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or minimizing disturbance to suitable riparian habitats and avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species. The potential for impact and need for mitigation should be determined in consultation with the USFWS under Section 7 of the ESA.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Birds (Cont.)							
Western burrowing owl	<i>Athene cunicularia hypugaea</i>	BLM-S; FWS-SC	Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dog, badger, etc.). Nearest quad-level occurrence is approximately 14 mi east of the SEZ. About 4,376,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	97,000 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied burrows in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Western snowy plover	<i>Charadrius alexandrinus nivosus</i>	AZ-WSC; AZ-S1	Breeds on alkali flats around reservoirs and sandy shorelines. Nearest quad-level occurrence is 7 mi (11 km) south of the SEZ. About 400,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,100 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Birds (Cont.)</i>							
Western yellow-billed cuckoo	<i>Coccyzus americanus</i>	ESA-C; AZ-WSC	Considered to be a riparian obligate, usually found in large tracts of cottonwood/willow habitats with dense sub-canopies. Quad-level occurrences intersect the affected area. About 50,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (4.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable riparian habitats for this species may be directly affected in the access road corridor or may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or minimizing disturbance to suitable riparian habitats and avoiding or limiting groundwater withdrawals for solar energy development on the SEZ could reduce impacts on this species. The potential for impact and need for mitigation should be determined in coordination with the USFWS and AZGFD.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Birds (Cont.)</i>							
Yuma clapper rail	<i>Rallus longirostris yumanensis</i>	ESA-E; AZ-WSC	Year-round resident in the SEZ region. Freshwater marshes containing dense stands of cattails. Nests on dry hummocks or in small shrubs among dense cattails or bulrushes along the edges of shallow ponds in freshwater marshes with stable water levels. Quad-level occurrences intersect the affected area. About 50,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (4.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable aquatic or riparian habitats for this species may be directly affected in the access road corridor or may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species. The potential for impact and need for mitigation should be determined in consultation with the USFWS under Section 7 of the ESA.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
<i>Mammals</i>							
California leaf-nosed bat	<i>Macrotus californicus</i>	BLM-S; AZ-WSC; FWS-SC	Year-round resident in desert riparian, desert wash, desert scrub, and palm oasis habitats at elevations below 2,000 ft. Roosts in mines, caves, and buildings. Quad-level occurrences intersect the affected area. About 3,960,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	21 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	85,900 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact. No direct impact on roost habitat. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Cave myotis	<i>Myotis velifer</i>	FWS-SC	Lower Colorado River Basin in southeastern California and southwestern Arizona in desert scrub, shrublands, washes, and riparian habitats. Roosts in colonies in caves. Quad-level occurrences intersect the affected area. About 4,265,700 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	86,100 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. No direct impact on roost habitat. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status ^a	Habitat ^b	Maximum Area of Potential Habitat Affected ^c			Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^d	Access Road (Direct Effects) ^e	Indirect Effects (Outside SEZ) ^f	
Mammals (Cont.)							
Western red bat	<i>Lasiurus blossevillii</i>	BLM-S; AZ-WSC	Year-round resident in SEZ region. Forages in riparian and other wooded areas. Roosts primarily in cottonwood trees along riparian areas. Nearest recorded quad-level occurrence is from the Hassayampa River, approximately 50 mi north of the SEZ. About 17,400 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	625 acres of potentially suitable foraging or roosting habitat (3.6 % of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Western yellow bat	<i>Lasiurus xanthinus</i>	BLM-S; AZ-WSC; AZ-S2	Year-round resident in desert riparian, desert wash, and palm oasis habitats at elevations below 2,000 ft. Roosts in trees. Nearest quad-level occurrence is from the vicinity of Phoenix, approximately 40 mi northeast of the SEZ. About 4,407,500 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable foraging or roosting habitat lost (<0.1% of available potentially suitable habitat)	87,500 acres of potentially suitable foraging or roosting habitat (2.0% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian woodlands in the access road corridor could reduce impacts to foraging or roosting habitat. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied roosting areas in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

Footnotes on next page.

TABLE 8.3.12.1-1 (Cont.)

-
- ^a AZ-S1 = ranked as S1 in the State of Arizona; AZ-S2 = ranked as S2 in the State of Arizona; AZ-SR = salvage restricted plant species under the Arizona Native Plant Law; AZ-WSC = listed as a wildlife species of concern in the State of Arizona; BLM-S = listed as a sensitive species by the BLM; ESA-T = listed as threatened under the ESA; ESA-UR = under review for listing under the ESA; FWS-SC = USFWS species of concern.
- ^b For plant species, potentially suitable habitat was determined by using SWReGAP land cover types. For terrestrial vertebrate species, potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.
- ^c Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. Impacts of transmission line construction, upgrade, or operation are not assessed in this evaluation due to the proximity of existing infrastructure to the SEZ.
- ^d Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.
- ^e For access road development, direct effects were estimated within a 3-mi (5-km), 60-ft (18-m) wide road corridor from the SEZ to the nearest existing state or federal highway. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide access road corridor. No new transmission was assumed to be needed for this SEZ due to the proximity of an existing ROW.
- ^f Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portion of the access road corridor where ground disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. Indirect effects on groundwater-dependent species were considered outside these defined areas.
- ^g Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq 1\%$ of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq 10\%$ of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: $>10\%$ of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.
- ^h Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.
- ⁱ To convert mi to km, multiply by 1.609.
- ^j To convert acres to km², multiply by 0.004047.
- ^k Species in bold text have been recorded or have designated critical habitat within 5 mi (8 km) of the SEZ boundary.
- ^l To convert ft to m, multiply by 0.3048.

1 the assumed access road corridor (Figure 8.3.12.1-1). On the basis of the SWReGAP land cover
2 model, approximately 2,000 acres (8 km²) of riparian habitat occurs within the affected area
3 (Table 8.3.12.1-1). This riparian habitat and other riparian habitat areas further downstream
4 along the Gila River may be dependent on surface discharges from the lower Hassayampa River
5 Groundwater Basin. Designated critical habitat for this species does not occur within the SEZ
6 region.

9 **Yuma Clapper Rail**

10
11 The Yuma clapper rail occurs in freshwater marsh habitats containing dense vegetation
12 such as cattail (*Typha* sp.), bulrush (*Scirpus* sp), or reeds (*Phragmites* sp.) from Needles,
13 California south and west to the Salton Sea and southeast to Arizona and Mexico. Although
14 the SWReGAP habitat suitability model for the Yuma Clapper rail does not identify any
15 suitable habitat for this species within the affected area, quad-level occurrences for this species
16 intersect the affected area, and these occurrences are presumably from riparian habitats along
17 the Hassayampa and Gila Rivers east of the SEZ within the area of indirect effects and the
18 assumed access road corridor (Figure 8.3.12.1-1). On the basis of the SWReGAP land cover
19 model, approximately 2,000 acres (8 km²) of riparian habitat occurs within the affected area
20 (Table 8.3.12.1-1). This riparian habitat and other riparian habitat areas farther downstream
21 along the Gila River may be dependent on surface discharges from the lower Hassayampa River
22 Groundwater Basin. Designated critical habitat for this species does not occur within the SEZ
23 region.

26 **8.3.12.1.2 Species That Are Candidates for Listing under the ESA**

27
28 In its scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS
29 identified 2 species that are candidates for listing under the ESA that may be impacted by solar
30 energy development on the Gillespie SEZ: the Tucson shovel-nosed snake and the western
31 yellow-billed cuckoo. These 2 species are discussed below and information on their habitat is
32 presented in Table 8.3.12.1-1; additional basic information on life history, habitat needs, and
33 threats to populations of these species is provided in Appendix J.

36 **Tucson Shovel-Nosed Snake**

37
38 The Tucson shovel-nosed snake is a fairly small snake that is one of three subspecies
39 of the western shovel-nosed snake known to occur in Arizona. The other two subspecies of the
40 western shovel-nosed snakes – the Colorado Desert shovel-nosed snake (*Chionactis occipitalis*
41 *annulata*) and Mojave shovel-nosed snake (*C. o. occipitalis*) may also occur in the affected area
42 of the SEZ but these two species are not special status species. The Tucson shovel-nosed snake
43 occupies the eastern-most portion of the species' range in Maricopa and Pinal Counties. The
44 Tucson shovel-nosed snake is found in low desert regions where it inhabits creosote-mesquite
45 communities with soft sandy substrates. The species is usually found near sandy washes, dunes,
46 or bajadas. The nearest quad-level occurrence for this species is approximately 20 mi (32 km)

1 southeast of the SEZ. According to the SWReGAP habitat suitability model, approximately
2 98,500 acres (399 km²) of potentially suitable habitat for the western shovel-nosed snake (not
3 specifically the Tucson subspecies) may occur in the affected area of the SEZ (Figure 8.3.12.1-1;
4 Table 8.3.12.1-1). However, this area is situated in an intergrade zone where all three subspecies
5 of the western shovel-nosed snake may co-occur and interbreed.
6
7

8 **Western Yellow-Billed Cuckoo**

9

10 The western yellow-billed cuckoo is a neotropical migrant bird that inhabits large
11 riparian woodlands in the western United States. Although the SWReGAP habitat suitability
12 model for the western yellow-billed cuckoo does not identify any suitable habitat for this
13 species within the affected area, quad-level occurrences for this species intersect the affected
14 area, and these occurrences are presumably from riparian habitats along the Hassayampa and
15 Gila Rivers east of the SEZ within the area of indirect effects and the assumed access road
16 corridor (Figure 8.3.12.1-1). On the basis of the SWReGAP land cover model, approximately
17 2,000 acres (8 km²) of riparian habitat occurs within the affected area (Table 8.3.12.1-1). This
18 riparian habitat and other riparian habitat areas further downstream along the Gila River may
19 be dependent on surface discharges from the lower Hassayampa River Groundwater Basin.
20

21 **8.3.12.1.3 Species That Are under Review for Listing under the ESA**

22

23
24 In their scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS
25 identified one species under ESA review that may be directly or indirectly affected by solar
26 energy development on the SEZ—the Sonoran population of the desert tortoise. This distinct
27 population segment of desert tortoise occurs south and east of the Colorado River (Mojave
28 populations north and west of the Colorado River are currently listed as threatened under the
29 ESA, but are outside of the affected area of the Gillespie SEZ). The Sonoran population of the
30 desert tortoise was petitioned for listing under the ESA on October 9, 2008 (WildEarth
31 Guardians and Western Watersheds Project 2008). Quad-level occurrences for this species
32 intersect the Gillespie SEZ and other portions of the affected area (Figure 8.3.12.1-1). According
33 to the SWReGAP land cover model, approximately 2,618 acres (11 km²) of potentially suitable
34 for this species occurs on the SEZ; approximately 76,700 acres (310 km²) of potentially suitable
35 habitat occurs in the area of indirect effects (Table 8.3.12.1-1). The USGS desert tortoise
36 model (Nussear et al. 2009) does not encompass the same geographic area as the Gillespie SEZ;
37 however, BLM-developed Category II habitats for the Sonoran desert tortoise exist immediately
38 south and east of the SEZ at Gila Bend. These BLM habitat categories are used for BLM
39 planning and land management (as reviewed in WildEarth Guardians and Western Watersheds
40 Project 2008). Category I habitats are the most essential for the maintenance of large long-term
41 populations; Category II habitats are intermediate in the maintenance of large long-term
42 populations; Category III habitats are not essential to the maintenance of viable long-term
43 populations and are identified to limit further declines in the population size to the extent
44 practical. Additional basic information on life history, habitat needs, and threats to populations of
45 these species is provided in Appendix J.
46

1 **8.3.12.1.4 BLM-Designated Sensitive Species**
2

3 There are 14 BLM-designated sensitive species that may occur in the affected area of the
4 Gillespie SEZ (Table 8.3.12.1-1). These BLM-designated sensitive species include the following
5 (1) plants: Hohokam agave and Tumamoc globeberry; (2) fish: roundtail chub; (3) amphibian:
6 lowland leopard frog; (4) reptiles: Mexican rosy boa, Sonoran desert tortoise, and Tucson
7 shovel-nosed snake; (5) birds: ferruginous hawk, great egret, snowy egret, and western
8 burrowing owl; and (5) mammals: California leaf-nosed bat, western red bat, and western yellow
9 bat. Of these BLM-designated sensitive species with potentially suitable habitat in the affected
10 area, only quad-level occurrences of the roundtail chub, lowland leopard frog, Sonoran desert
11 tortoise, and California leaf-nosed bat intersect the affected area of the Gillespie SEZ. Habitats in
12 which BLM-designated sensitive species are found, the amount of potentially suitable habitat in
13 the affected area, and known locations of the species relative to the SEZ are presented in Table
14 8.3.12.1-1. Two of these species—the Sonoran desert tortoise and Tucson shovel-nosed snake—
15 have been previously discussed due to their known or pending status under the ESA
16 (Sections 8.3.12.1.2 and 8.3.12.1.3). All other BLM-designated sensitive species as related to the
17 SEZ are described in the remainder of this section. Additional life history information for these
18 species is provided in Appendix J.
19
20

21 **Hohokam Agave**
22

23 The Hohokam agave is a perennial shrub endemic to Arizona and adjacent Sonora,
24 Mexico. It occurs on desert benches or alluvial terraces near bajadas, washes, or other major
25 drainages in desert scrub communities. Nearest quad-level occurrences of this species are
26 approximately 45 mi (72 km) north of the SEZ. Although it is not known to occur in the affected
27 area, potentially suitable desert riparian habitat may occur in the access road corridor and other
28 portions of the affected area (Table 8.3.12.1-1).
29
30

31 **Tumamoc Globeberry**
32

33 The Tumamoc globeberry is a perennial herb that is known from southern Arizona and
34 adjacent Sonora, Mexico. It occurs in xeric situations, primarily along hillsides and washes.
35 Nearest quad-level occurrences of this species are approximately 35 mi (56 km) southeast of the
36 SEZ. Although it is not known to occur in the affected area, potentially suitable desert wash and
37 riparian habitat may occur in the access road corridor and other portions of the affected area
38 (Table 8.3.12.1-1).
39
40

41 **Roundtail Chub**
42

43 The roundtail chub is known from larger tributaries in the Colorado Basin, from
44 Wyoming south to Arizona and New Mexico. It occupies cool to warm water streams and rivers
45 consisting of pools adjacent to riffles and runs. Historic quad-level occurrences for this species
46 intersect the affected area from the Gila River, within 5 mi (8 km) east of the SEZ. The species is

1 currently not known to occur in the affected area. On the basis of an evaluation of surface water
2 features in the SEZ region, about 300 mi (483 km) of potentially suitable habitat within the Gila
3 and Hassayampa Rivers occurs within the SEZ region (Table 8.3.12.1-1).
4
5

6 **Lowland Leopard Frog**

7

8 The lowland leopard frog is a medium-sized frog primarily known from central and
9 southern Arizona, although the species is also known to occur in western New Mexico and
10 northern Mexico. It inhabits aquatic to mesic systems such as grasslands, pinyon-juniper forests,
11 agricultural areas, lakes, streams, and reservoirs. Nearest quad-level occurrences of this species
12 intersect the affected area of the Gillespie SEZ. Occurrences of this species are known from the
13 Gila River, within 5 mi (8 km) east of the SEZ. According to the SWReGAP habitat suitability
14 model, potentially suitable habitat for this species occurs on the SEZ and throughout portions of
15 the affected area (Table 8.3.12.1-1).
16
17

18 **Mexican Rosy Boa**

19

20 The Mexican rosy boa is a snake known from the Sonoran Desert in Arizona and adjacent
21 Mexico. This snake inhabits arid scrublands, rocky deserts, and canyons near washes or streams.
22 Nearest quad-level occurrences of this species are approximately 20 mi (32 km) southeast of the
23 SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this
24 species occurs on the SEZ and throughout portions of the affected area (Table 8.3.12.1-1).
25
26

27 **Ferruginous Hawk**

28

29 The ferruginous hawk is known to occur throughout the western United States.
30 According to the SWReGAP habitat suitability model, only potentially suitable winter foraging
31 habitat for this species may occur within the affected area of the Gillespie SEZ. This species
32 inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper
33 woodlands. This species is known to occur in Maricopa County, Arizona. According to the
34 SWReGAP habitat suitability model, suitable habitat for this species does not occur within the
35 area of direct effects; however, potentially suitable foraging habitat occurs in portions of the
36 area of indirect effects outside of the SEZ (Table 8.3.12.1-1).
37
38

39 **Great Egret**

40

41 The great egret is a year-round resident in the lower Colorado River Valley. This species
42 is primarily associated with open water areas such as marshes, estuaries, lagoons, lakes, ponds,
43 rivers and flooded fields. The nearest quad-level occurrence is from Painted Rock Reservoir,
44 approximately 11 mi (18 km) south of the SEZ. According to the SWReGAP habitat suitability
45 model, potentially suitable habitat for this species does not occur in the area of direct effects;
46 however, potentially suitable habitat may occur in portions of the area of indirect effects,

1 primarily along the Hassayampa and Gila Rivers (Table 8.3.12.1-1). In addition potentially
2 suitable aquatic and riparian habitats associated with the Gila River may be influenced by
3 groundwater discharge from the Lower Hassayampa River Groundwater Basin.
4

6 **Snowy Egret**

7
8 The snowy egret is considered to be a year-round resident in the lower Colorado River
9 Valley in southwestern Arizona and southeastern California. This species is primarily associated
10 with open water areas such as marshes, lakes, ponds, and reservoirs. The nearest quad-level
11 occurrence is from Painted Rock Reservoir, approximately 11 mi (18 km) south of the SEZ.
12 According to the SWReGAP habitat suitability model, potentially suitable habitat for this
13 species occurs on the SEZ and throughout portions of the affected area (Table 8.3.12.1-1).
14 However, there are no permanent surface water features in the area of direct effects that may
15 provide suitable habitat; therefore, this species would only be expected to occur in the area
16 of direct effects as a transient. In addition, potentially suitable aquatic and riparian habitats
17 associated with the Hassayampa and Gila Rivers may be influenced by groundwater discharge
18 from the Lower Hassayampa River Groundwater Basin.
19

21 **Western Burrowing Owl**

22
23 The western burrowing owl is known to occur in the SEZ region, where it forages in
24 grasslands, shrublands, open disturbed areas, and nests in burrows usually constructed by
25 mammals. According to the SWReGAP habitat suitability model for the western burrowing owl,
26 potentially suitable year-round foraging and nesting habitat may occur in the affected area of the
27 Gillespie SEZ. Nearest recorded quad-level occurrences of this species are approximately 14 mi
28 (22 km) south of the SEZ. Potentially suitable foraging and breeding habitat is expected to occur
29 in the area of direct effects and in other portions of the affected area (Table 8.3.12.1-1). The
30 availability of nest sites (burrows) within the affected area has not been determined, but
31 shrubland habitat that may be suitable for either foraging or nesting occurs throughout the
32 affected area.
33

35 **California Leaf-Nosed Bat**

36
37 The California leaf-nosed bat is a large-eared bat with a leaflike flap of protective skin on
38 the tip of its nose. It primarily occurs along the Colorado River from southern Nevada, through
39 Arizona and California, to Baja California and Sinaloa Mexico. The species forages in a variety
40 of desert habitats including desert riparian, desert wash, desert scrub, and palm oasis. It roosts in
41 caves, crevices, and mines. Quad-level occurrences of this species intersect the affected area of
42 the Gillespie SEZ. According to the SWReGAP habitat suitability model, potentially suitable
43 year-round foraging habitat for this species may occur on the SEZ, portions of the access road
44 corridor, and throughout the affected area (Table 8.3.12.1-1). On the basis of an evaluation of
45 SWReGAP land cover types, however, there is no suitable roosting habitat (rocky cliffs and
46 outcrops) within the affected area.

1 **Western Red Bat**

2
3 The western red bat is an uncommon year-round resident in the Gillespie SEZ region
4 where it forages in desert riparian and other woodland areas. This species may occasionally
5 forage in desert shrubland habitats. The species primarily roosts in trees in riparian areas.
6 Nearest recorded occurrences of this species are approximately 50 mi (80 km) north of the SEZ.
7 According to the SWReGAP habitat suitability model, there is no suitable habitat within the area
8 of direct effects; however, potentially suitable habitat may occur in the area of indirect effects
9 outside the SEZ (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP land cover
10 types, riparian woodland habitat that may be potentially suitable roosting habitat could occur
11 in the area of indirect effects.
12

13
14 **Western Yellow Bat**

15
16 The western yellow bat is an uncommon year-round resident in the Gillespie SEZ region
17 where it forages in desert riparian and desert oasis habitats. The species roosts in trees. Nearest
18 recorded occurrences of this species are approximately 40 mi (64 km) northeast of the SEZ.
19 According to the SWReGAP habitat suitability model, potentially suitable year-round foraging
20 habitat for this species may occur on the SEZ, portions of the access road corridor, and
21 throughout the affected area (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP
22 land cover types, riparian woodland habitat that may be potentially suitable roosting habitat
23 could occur in the area of indirect effects.
24

25
26 **8.3.12.1.5 State-Listed Species**

27
28 There are 18 species listed by the State of Arizona that may occur in the Gillespie SEZ
29 affected area (Table 8.3.12.1-1). These state-listed species include the following (1) plants:
30 California barrel cactus, Hohokam agave, straw-top cholla, and Tumamoc globeberry; (2) fish:
31 roundtail chub; (3) amphibian: lowland leopard frog; (4) reptile: Sonoran desert tortoise;
32 (5) birds: Sonoran bald eagle, ferruginous hawk, great egret, snowy egret, southwestern willow
33 flycatcher, western snowy plover, western yellow-billed cuckoo, and Yuma clapper rail; and
34 (6) mammals: California leaf-nosed bat, western red bat, and western yellow bat. All of these
35 species are protected in Arizona under the Arizona Native Plant Law or by the AZGFD as
36 Wildlife of Special Concern (WSC). Of these species, the following 3 species have not been
37 previously described due to their known or pending status under the ESA (Section 8.3.12.1.1,
38 8.3.12.1.2, or 8.3.12.1.3) or BLM-designated sensitive (Section 8.3.12.1.4): California barrel
39 cactus, straw-top cholla, and western snowy plover. These species as related to the SEZ are
40 described in this section and Table 8.3.12.1-1. Additional life history information for these
41 species is provided in Appendix J.
42

43
44 **California Barrel Cactus**

45
46 The California barrel cactus is a perennial cactus endemic to western Arizona and
47 southeastern California. This species occurs on gravelly or rocky hillsides, canyon walls, alluvial

1 fans, and desert washes. Nearest quad-level occurrences intersect the affected area of the
2 Gillespie SEZ (Table 8.3.12.1-1). According to the SWReGAP land cover model, potentially
3 suitable desert riparian habitat does not occur on the SEZ but potentially suitable desert wash or
4 riparian habitat occurs within the access road corridor and portions of the area of indirect effects.
5
6

7 **Straw-Top Cholla**

8
9 The straw-top cholla is a perennial shrub-like cactus that is known from the southwestern
10 United States. This species occurs on sandy or gravelly soils on desert flats, mesas, and washes.
11 Quad-level occurrences of this species intersect the affected area of the Gillespie SEZ
12 (Table 8.3.12.1-1). According to the SWReGAP land cover model, potentially suitable desert
13 riparian habitat does not occur on the SEZ but potentially suitable desert wash or riparian habitat
14 occurs within the access road corridor and in portions of the area of indirect effects.
15
16

17 **Western Snowy Plover**

18
19 The western snowy plover is known throughout the western United States and breeds on
20 alkali flats around reservoirs and sandy shorelines. This species is a known summer breeder and
21 winter resident in portions of the six-state solar energy region. The nearest quad-level occurrence
22 of this species is 7 mi (11 km) south of the SEZ. According to the SWReGAP habitat suitability
23 model, potentially suitable habitat for this species does not occur anywhere within the SEZ or
24 within the access road corridor; however, some potentially suitable aquatic or riparian habitat
25 may occur in the area of indirect effects.
26
27

28 **8.3.12.1.6 Rare Species**

29
30 There are 22 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern
31 by the USFWS) that may be affected by solar energy development on the Gillespie SEZ
32 (Table 8.3.12.1-1). Of these species, there are eight rare species that have not been discussed
33 previously. These include the following (1) plants: arid tansy-aster and California snakewood;
34 (2) invertebrate: Maricopa tiger beetle; (3) amphibian: Arizona toad; (4) reptile: Gila monster;
35 (5) birds: cattle egret and long-eared owl; and (6) mammal: cave myotis. These species as related
36 to the SEZ are described in Table 8.3.12.1-1.
37
38

39 **8.3.12.2 Impacts**

40
41 The potential for impacts on special status species from utility-scale solar energy
42 development within the proposed Gillespie SEZ is presented in this section. The types of impacts
43 that special status species could incur from construction and operation of utility-scale solar
44 energy facilities are discussed in Section 5.10.4.
45

1 The assessment of impacts to special status species is based on available information
2 on the presence of species in the affected area as presented in Section 8.3.12.1 following the
3 analysis approach described in Appendix M. It is assumed that, prior to development, surveys
4 would be conducted to determine the presence of special status species and their habitats in
5 and near areas where ground-disturbing activities would occur. Additional NEPA assessments,
6 ESA consultations, and coordination with state natural resource agencies may be needed to
7 address project-specific impacts more thoroughly. These assessments and consultations could
8 result in additional required actions to avoid, minimize, or mitigate impacts on special status
9 species (see Section 8.3.12.3).

10
11 Solar energy development within the Gillespie SEZ could affect a variety of habitats
12 (see Sections 8.3.9 and 8.3.10). These impacts on habitats could in turn affect special status
13 species that are dependent on those habitats. Based on ANHP records, quad-level occurrences
14 for the following 10 special status species intersect the Gillespie affected area: California
15 barrel cactus, straw-top cholla, roundtail chub, lowland leopard frog, Sonoran desert tortoise,
16 southwestern willow flycatcher, western yellow-billed cuckoo, Yuma clapper rail, California
17 leaf-nosed bat, and cave myotis. Suitable habitat for each of these species may occur in the
18 affected area. Suitable aquatic or riparian habitat associated with the Gila River within 10 mi
19 (16 km) downgradient (east-southeast) of the SEZ could be affected by groundwater withdrawals
20 from the Lower Hassayampa River Groundwater Basin to serve solar energy development on
21 the Gillespie SEZ. Special status species with aquatic or riparian habitats associated with the
22 Gila River that may be affected by groundwater withdrawals to serve development on the SEZ
23 include the following: roundtail chub, Arizona toad, lowland leopard frog, cattle egret, great
24 egret, snowy egret, southwestern willow flycatcher, western yellow-billed cuckoo, and Yuma
25 clapper rail. Other special status species may occur on the SEZ or within the affected area based
26 on the presence of potentially suitable habitat. As discussed in Section 8.3.12.1, this approach to
27 identifying the species that could occur in the affected area probably overestimates the number of
28 species that actually occur in the affected area, and may therefore overestimate impacts to some
29 special status species.

30
31 Potential direct and indirect impacts on special status species within the SEZ, access road
32 corridor, and in the area of indirect effects outside the SEZ are presented in Table 8.3.12.1-1. In
33 addition, the overall potential magnitude of impacts on each species (assuming programmatic
34 design features are in place) is presented along with any potential species-specific mitigation
35 measures that could further reduce impacts.

36
37 Impacts on special status species could occur during all phases of development
38 (construction, operation, and decommissioning and reclamation) of a utility-scale solar energy
39 project within the SEZ. Construction and operation activities could result in short- or long-term
40 impacts on individuals and their habitats, especially if these activities are sited in areas where
41 special status species are known to or could occur. As presented in Section 8.3.1.2, it is assumed
42 that a new 3-mile (5-km) long access road would be created to connect existing infrastructure to
43 the SEZ (Figure 8.3.12.1-1). No new transmission development is assumed due to the proximity
44 of an existing transmission ROW.

1 Direct impacts would result from habitat destruction or modification. It is assumed
2 that direct impacts would occur only within the SEZ and access road corridor where ground-
3 disturbing activities are expected to occur. Indirect impacts could result from depletions of
4 groundwater resources, surface water and sediment runoff from disturbed areas, fugitive dust
5 generated by project activities, accidental spills, harassment, and lighting. No ground disturbing
6 activities associated with project developments are anticipated to occur within the area of
7 indirect effects. Decommissioning of facilities and reclamation of disturbed areas after
8 operations cease could result in short-term negative impacts to individuals and habitats adjacent
9 to project areas, but long-term benefits would accrue if original land contours and native plant
10 communities were restored in previously disturbed areas.

11
12 The successful implementation of programmatic design features (discussed in
13 Appendix A) would reduce direct impacts on some special status species, especially those that
14 depend on habitat types that can be easily avoided (e.g., desert riparian habitats). Indirect impacts
15 on special status species could be reduced to negligible levels by implementing programmatic
16 design features, especially those engineering controls that would reduce groundwater
17 consumption, runoff, sedimentation, spills, and fugitive dust.

18 19 20 ***8.3.12.2.1 Impacts on Species Listed under the ESA***

21
22
23 In their scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS
24 expressed concern for impacts of project development within the SEZ on the southwestern
25 willow flycatcher and Yuma clapper rail—two bird species listed as endangered under the ESA.
26 In addition to these species, the Sonoran bald eagle—listed as threatened under the ESA – may
27 also be affected by project developments on the SEZ. Impacts to these species are discussed
28 below and summarized in Table 8.3.12.1-1.

29 30 31 **Sonoran Bald Eagle**

32
33 The Sonoran population of the bald eagle is currently listed as threatened under the ESA⁶
34 and is known to occur along the Gila River, approximately 15 mi (24 km) south of the SEZ
35 (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, only winter
36 foraging habitat is expected to occur in the affected area. Approximately 2,618 acres (11 km²) of
37 potentially suitable foraging habitat within the SEZ and 22 acres (0.1 km²) of potentially suitable
38 foraging habitat within the access road corridor could be directly affected by construction and
39 operations of solar energy development on the Gillespie SEZ. This direct effects area represents
40 about 0.1% of available suitable habitat in the region. About 98,500 acres (399 km²) of suitable
41 foraging habitat occurs in the area of potential indirect effects; this area represents about 2.1% of
42 the available suitable habitat in the region (Table 8.3.12.1-1). On the basis of SWReGAP land
43 cover data, there is relatively little suitable aquatic and riparian habitat (2,100 acres [8 km²]) in
44 the affected area. Therefore, most of this potentially suitable foraging habitat is desert shrubland.

⁶ A recent finding by the USFWS has indicated that listing of this species under the ESA is no longer warranted (USFWS 2010b).

1 The overall impact on the bald eagle from construction, operation, and decommissioning
2 of utility-scale solar energy facilities within the Gillespie SEZ is considered small because the
3 amount of potentially suitable foraging habitat for this species in the area of direct effects
4 represents less than 1% of potentially suitable foraging habitat in the SEZ region. The
5 implementation of programmatic design features is expected to be sufficient to reduce indirect
6 impacts on this species to negligible levels. Avoidance of potentially suitable foraging habitats
7 for this species is not a feasible means of mitigating impacts because these habitats (desert scrub)
8 are widespread throughout the area of direct effect.
9

10 Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
11 reasonable and prudent measures, and terms and conditions) on the Sonoran population of the
12 bald eagle, including development of a survey protocol, avoidance measures, minimization
13 measures, and, potentially, compensatory mitigation, would require consultation with the
14 USFWS per Section 7 of the ESA. This consultation may also be used to develop incidental take
15 statements per Section 10 of the ESA (if necessary). Consultation with AZGFD should also
16 occur to determine any state mitigation requirements.
17
18

19 **Southwestern Willow Flycatcher**

20

21 The southwestern willow flycatcher is listed as endangered under the ESA and is
22 known to occur in the affected area of the Gillespie SEZ (Figure 8.3.12.1-1). According to the
23 SWReGAP habitat suitability model, suitable habitat for this species does not occur anywhere
24 within the affected area. However, quad-level occurrences of the species in the area of indirect
25 effects and the assumed access road corridor are presumably from the Hassayampa and Gila
26 Rivers to the east of the SEZ. On the basis of SWReGAP land cover types, approximately
27 2,000 acres (8 km²) of potentially suitable riparian shrubland and woodland habitat occurs within
28 the affected area; about 2 acres (<0.01 km²) of riparian habitat occurs within the assumed access
29 road corridor (Figure 8.3.12.1-1). The riparian habitat within the indirect effects area represents
30 about 4.0% of the available suitable habitat in the region; that within the access road corridor
31 represents less than 0.1% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1).
32 On the basis of SWReGAP habitat suitability and land cover models, potentially suitable habitat
33 for this species does not occur within the area of direct effects.
34

35 Riparian habitats within the affected area of the Gillespie SEZ that may provide suitable
36 nesting and foraging habitat for the southwestern willow flycatcher may be dependent on surface
37 discharges from the Lower Hassayampa River Groundwater Basin and may be affected by
38 groundwater withdrawals to serve development on the Gillespie SEZ. Impacts of groundwater
39 depletion from solar energy development in the Gillespie SEZ cannot be quantified without
40 identification of the cumulative amount of groundwater withdrawals needed to support
41 development on the SEZ. Consequently, the overall impact on the southwestern willow
42 flycatcher could range from small to large, and would depend in part on the solar energy
43 technology deployed, the scale of development within the SEZ, the type of cooling system used,
44 and the degree of influence water withdrawals in the SEZ would have on drawdown and surface
45 water discharges in habitats supporting these species (Table 8.3.12.1-1).
46

1 The implementation of programmatic design features, avoiding or minimizing
2 disturbance to riparian habitats in the assumed access road corridor, and avoidance or limitations
3 of groundwater withdrawals from the regional groundwater system could reduce impacts on the
4 southwestern willow flycatcher to small or negligible levels. Impacts can be better quantified for
5 specific projects once water needs are identified.
6

7 Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
8 reasonable and prudent measures, and terms and conditions) on the southwestern willow
9 flycatcher, including development of a survey protocol, avoidance measures, minimization
10 measures, and, potentially, compensatory mitigation, would require consultation with the
11 USFWS per Section 7 of the ESA. This consultation may also be used to develop incidental take
12 statements per Section 10 of the ESA (if necessary). Consultation with AZGFD should also
13 occur to determine any state mitigation requirements.
14

15 **Yuma Clapper Rail**

16
17
18 The Yuma clapper rail is listed as endangered under the ESA and is known to occur in
19 the affected area of the Gillespie SEZ (Figure 8.3.12.1-1). According to the SWReGAP habitat
20 suitability model, suitable habitat for this species does not occur anywhere within the affected
21 area. However, quad-level occurrences of the species in the area of indirect effects and the
22 assumed access road corridor are presumably from the Hassayampa and Gila Rivers to the east
23 of the SEZ. On the basis of SWReGAP land cover types, approximately 2,000 acres (8 km²) of
24 potentially suitable riparian shrubland and woodland habitat occurs within the affected area;
25 about 2 acres (<0.01 km²) of riparian habitat occurs within the assumed access road corridor
26 (Figure 8.3.12.1-1). The riparian habitat within the indirect effects area represents about 4.0% of
27 the available suitable habitat in the region; that within the access road corridor represents less
28 than 0.1% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1). On the basis of
29 SWReGAP habitat suitability and land cover models, potentially suitable habitat for this species
30 does not occur within the area of direct effects.
31

32 Aquatic and riparian habitats outside of the area of direct effects that may provide
33 suitable habitat for the Yuma clapper rail may be dependent on surface discharges from the
34 Lower Hassayampa River Basin and may be affected by groundwater withdrawals to serve
35 development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher,
36 impacts on this species could range from small to large depending upon the solar energy
37 technology deployed, the scale of development within the SEZ, and the cumulative rate of
38 groundwater withdrawals (Table 8.3.12.1-1).
39

40 The implementation of programmatic design features, avoiding or minimizing
41 disturbance to riparian habitats in the assumed access road corridor, and avoidance or limitations
42 of groundwater withdrawals from the regional groundwater system could reduce impacts on the
43 Yuma clapper rail to small or negligible levels. Impacts can be better quantified for specific
44 projects once water needs are identified.
45

1 Development of actions to reduce impacts (e.g., reasonable and prudent alternatives,
2 reasonable and prudent measures, and terms and conditions) on the southwestern willow
3 flycatcher, including development of a survey protocol, avoidance measures, minimization
4 measures, and, potentially, compensatory mitigation, would require consultation with the
5 USFWS per Section 7 of the ESA. This consultation may also be used to develop incidental take
6 statements per Section 10 of the ESA (if necessary). Consultation with AZGFD should also
7 occur to determine any state mitigation requirements.
8
9

10 **8.3.12.2.2 Impacts on Species That Are Candidates for Listing under the ESA**

11

12 In their scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS
13 expressed concern for impacts of project development within the SEZ on 2 species that are
14 candidates for listing under the ESA: the Tucson shovel-nosed snake and the western yellow-
15 billed cuckoo. Impacts to these species are discussed below and summarized in Table 8.3.12.1-1.
16
17

18 **Tucson Shovel-Nosed Snake**

19

20 The Tucson shovel-nosed snake is one of three subspecies of the western shovel-nosed
21 snake (*Chionactis occipitalis*) that are known to occur in Arizona. The Gillespie SEZ is situated
22 in a zone of integration where all three subspecies may occur and interbreed. The other two
23 subspecies—Colorado Desert shovel-nosed snake (*C. o. annulata*) and Mojave shovel-nosed
24 snake (*C. o. occipitalis*)—are not special status species and are therefore not analyzed in this
25 PEIS. The Tucson shovel-nosed snake occupies eastern-most portion of the species' range in
26 Maricopa and Pinal Counties, Arizona. The Tucson shovel-nosed snake is found in low desert
27 regions where it inhabits creosote-mesquite communities with soft sandy substrates. The nearest
28 quad-level occurrences of this species are approximately 20 mi (32 km) southeast of the SEZ
29 (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, approximately
30 384 acres (2 km²) of potentially suitable habitat within the SEZ and 7 acres (<0.1 km²) of
31 potentially suitable habitat within the access road corridor could be directly affected by
32 construction and operations of solar energy development on the Gillespie SEZ. This direct
33 effects area represents less than 0.1% of available suitable habitat in the SEZ region. About
34 31,400 acres (127 km²) of suitable habitat occurs in the area of potential indirect effects; this
35 area represents about 2.2% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1).
36

37 The overall impact on the Tucson shovel-nosed snake from construction, operation, and
38 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
39 small because the amount of potentially suitable habitat for this species in the area of direct
40 effects represents less than 1% of potentially suitable habitat in the region. The implementation
41 of programmatic design features may be sufficient to reduce indirect impacts to negligible levels.
42

43 Avoidance of all potentially suitable habitats for this species is not a feasible means of
44 mitigating impacts because these habitats (desert scrub) are widespread throughout the area of
45 direct effect. Direct impacts could be reduced by conducting pre-disturbance surveys and
46 avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance

1 or minimization are not feasible options, individuals could be translocated from the area of direct
2 effects to protected areas that would not be affected directly or indirectly by future development.
3 Alternatively, or in combination with translocation, a compensatory mitigation plan could be
4 developed and implemented to mitigate direct effects on occupied habitats. Compensation could
5 involve the protection and enhancement of existing occupied or suitable habitats to compensate
6 for habitats lost to development. A comprehensive mitigation strategy that used one or more of
7 these options could be designed to completely offset the impacts of development.
8

9 Development of mitigation for the Tucson shovel-nosed snake, including development
10 of a survey protocol, avoidance measures, minimization measures, and, potentially, translocation
11 or compensatory mitigation, should be developed in coordination with the USFWS. Coordination
12 with AZGFD should also occur to determine any state mitigation requirements.
13

14 **Western Yellow-Billed Cuckoo**

15
16
17 The western yellow-billed cuckoo is known to occur in the affected area of the Gillespie
18 SEZ (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, suitable habitat
19 for this species does not occur anywhere within the affected area. However, quad-level
20 occurrences of the species in the area of indirect effects and the assumed access road corridor
21 are presumably from the Hassayampa and Gila Rivers to the east of the SEZ. On the basis of
22 SWReGAP land cover types, approximately 2,000 acres (8 km²) of potentially suitable riparian
23 shrubland and woodland habitat occurs within the affected area; about 2 acres (<0.01 km²) of
24 riparian habitat occurs within the assumed access road corridor (Figure 8.3.12.1-1). The riparian
25 habitat within the indirect effects area represents about 4.0% of the available suitable habitat in
26 the region; that within the access road corridor represents less than 0.1% of the available suitable
27 habitat in the SEZ region (Table 8.3.12.1-1). On the basis of SWReGAP habitat suitability and
28 land cover models, potentially suitable habitat for this species does not occur within the area of
29 direct effects.
30

31 Aquatic and riparian habitats outside of the area of direct effects that may provide
32 suitable habitat for the western yellow-billed cuckoo may be dependent on surface discharges
33 from the Lower Hassayampa River Groundwater Basin and may be affected by groundwater
34 withdrawals to serve development on the Gillespie SEZ. As discussed for the southwestern
35 willow flycatcher (Section 8.3.12.2.1), impacts on this species could range from small to large
36 depending upon the solar energy technology deployed, the scale of development within the SEZ,
37 and the cumulative rate of groundwater withdrawals (Table 8.3.12.1-1).
38

39 The implementation of programmatic design features, avoiding or minimizing
40 disturbance to riparian habitats in the assumed access road corridor, and avoidance or limitations
41 of groundwater withdrawals from the regional groundwater system could reduce impacts on the
42 western yellow-billed cuckoo to small or negligible levels. Impacts can be better quantified for
43 specific projects once water needs are identified.
44

45 Development of mitigation for the western yellow-billed cuckoo, including development
46 of a survey protocol, avoidance measures, minimization measures, and, potentially,

1 compensatory mitigation, should be developed in coordination with the USFWS. Coordination
2 with AZGFD should also occur to determine any state mitigation requirements.
3
4

5 ***8.3.12.2.3 Impacts on Species That Are under Review for Listing under the ESA*** 6

7 In scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS identified
8 one species under ESA review that may be directly or indirectly affected by solar energy
9 development on the SEZ, the Sonoran population of the desert tortoise. This distinct population
10 segment of desert tortoise occurs south and east of the Colorado River (Mojave populations north
11 and west of the Colorado River are currently listed as threatened under the ESA, but are outside
12 of the affected area of the Gillespie SEZ). Quad-level occurrences for this species intersect the
13 Gillespie SEZ and other portions of the affected area (Figure 8.3.12.1-1). According to the
14 SWReGAP habitat suitability model, approximately 2,618 acres (11 km²) of potentially suitable
15 habitat on the SEZ and 20 acres (0.1 km²) of potentially suitable habitat within the access road
16 corridor could be directly affected by construction and operations of solar energy development
17 on the SEZ (Table 8.3.12.1-1). This direct effects area represents about 0.1% of available
18 suitable habitat of the desert tortoise in the region. About 76,700 acres (310 km²) of suitable
19 habitat occurs in the area of potential indirect effects; this area represents about 2.0% of the
20 available suitable habitat in the region (Table 8.3.12.1-1).
21

22 The overall impact on the Sonoran population of the desert tortoise from construction,
23 operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ
24 is considered small because the amount of potentially suitable habitat for this species in the area
25 of direct effects represents less than 1% of potentially suitable habitat in the region. The
26 implementation of programmatic design features alone is unlikely to reduce these impacts to
27 negligible levels. Avoidance of potentially suitable habitats for this species is not a feasible
28 means of mitigating impacts because these habitats (desert scrub) are widespread throughout the
29 area of direct effect. Pre-disturbance surveys to determine the abundance of desert tortoises on
30 the SEZ and the implementation of a desert tortoise translocation plan and compensation plan
31 could reduce direct impacts.
32

33 Development of actions to reduce impacts for the desert tortoise, including a survey
34 protocol, avoidance measures, minimization measures, and, potentially, translocation actions,
35 and compensatory mitigation, should be conducted in coordination with the USFWS and
36 AZDFG.
37

38 There are inherent dangers to tortoises associated with their capture, handling, and
39 translocation from the SEZ. These actions, if done improperly, can result in injury or death. To
40 minimize these risks, the desert tortoise translocation plan should be developed in consultation
41 with the USFWS, and follow the *Guidelines for Handling Desert Tortoises During Construction*
42 *Projects* (Desert Tortoise Council 1994) and other current translocation guidance provided by the
43 USFWS or other state agencies. If considered appropriate, consultation will identify potentially
44 suitable recipient locations, density thresholds for tortoise populations in recipient locations,
45 procedures for pre-disturbance clearance surveys and tortoise handling, as well as disease testing
46 and post-translocation monitoring and reporting requirements. Despite some risk of mortality or

1 decreased fitness, translocation is widely accepted as a useful strategy for the conservation of the
2 desert tortoise (Field et al. 2007).

3
4 To offset impacts of solar development on the SEZ, compensatory mitigation may be
5 needed to balance the acreage of habitat lost with acquisition of lands that would be improved
6 and protected for desert tortoise populations (USFWS 1994). Compensation can be accomplished
7 by improving the carrying capacity for the desert tortoise on the acquired lands. Other mitigation
8 actions may include funding for the enhancement of desert tortoise habitat on existing federal
9 lands. Coordination with the USFWS and AZGFD would be necessary to determine the
10 appropriate mitigation ratio to acquire, enhance, and preserve desert tortoise compensation lands.
11

12 13 **8.3.12.2.4 Impacts on BLM-Designated Sensitive Species**

14
15 There are 12 BLM-designated sensitive species that are not previously discussed as
16 listed under the ESA, candidates, or under review for ESA listing. Impacts to these BLM-
17 designated sensitive species that may be affected by solar energy development on the Gillespie
18 SEZ are discussed below.
19

20 21 **Hohokam Agave**

22
23 The Hohokam agave is not known to occur in the affected area of the Gillespie SEZ
24 and suitable habitat does not occur on the SEZ; however, approximately 2 acres (<0.1 km²) of
25 potentially suitable riparian habitat in the access road corridor may be directly affected by
26 construction and operations of solar energy development on the SEZ (Table 8.3.12.1-1). This
27 direct effects area represents less than 0.1 % of available suitable habitat in the region. About
28 2,000 acres (8 km²) of potentially suitable riparian habitat occurs in the area of potential indirect
29 effects; this area represents about 3.9% of the available suitable habitat in the SEZ region
30 (Table 8.3.12.1-1).
31

32 The overall impact on the Hohokam agave from construction, operation, and
33 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
34 small because less than 1% of potentially suitable habitat for this species occurs in the area of
35 direct effects. The implementation of programmatic design features is expected to be sufficient to
36 reduce indirect impacts to negligible levels.
37

38 Avoiding or minimizing disturbance to riparian habitats in the assumed access road
39 corridor could reduce direct impacts on the Hohokam agave to negligible levels. For this species
40 and other special status plants, impacts also could be reduced by conducting pre-disturbance
41 surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects.
42 If avoidance or minimization are not feasible options, plants could be translocated from the area
43 of direct effects to protected areas that would not be affected directly or indirectly by future
44 development. Alternatively, or in combination with translocation, a compensatory mitigation
45 plan could be developed and implemented to mitigate direct effects on occupied habitats.
46 Compensation could involve the protection and enhancement of existing occupied or suitable

1 habitats to compensate for habitats lost to development. A comprehensive mitigation strategy
2 that used one or more of these options could be designed to completely offset the impacts of
3 development.

6 **Tumamoc Globeberry**

7
8 The Tumamoc globeberry is not known to occur in the affected area of the Gillespie
9 SEZ and suitable habitat does not occur on the SEZ; however, approximately 2 acres (<0.1 km²)
10 of potentially suitable riparian habitat in the access road corridor may be directly affected by
11 construction and operations of solar energy development on the SEZ (Table 8.3.12.1-1). This
12 direct effects area represents less than 0.1 % of available suitable habitat in the region. About
13 2,000 acres (8 km²) of potentially suitable riparian habitat occurs in the area of potential indirect
14 effects; this area represents about 3.9% of the available suitable habitat in the SEZ region
15 (Table 8.3.12.1-1).

16
17 The overall impact on the Tumamoc globeberry from construction, operation, and
18 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
19 small because less than 1% of potentially suitable habitat for this species occurs in the area of
20 direct effects. The implementation of programmatic design features is expected to be sufficient to
21 reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to riparian
22 habitats in the area of direct effects and the implementation of other mitigation measures
23 described previously for the Hohokam agave could reduce direct impacts on this species to
24 negligible levels. The need for mitigation, other than programmatic design features, should be
25 determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

28 **Roundtail Chub**

29
30 The roundtail chub is known from larger tributaries in the Colorado Basin, and is
31 historically known to occur in the affected area of the Gillespie SEZ from the Gila River,
32 within 5 mi (8 km) east of the SEZ. However, the species is currently not known to occur in
33 the affected area. On the basis of an evaluation of surface water features in the SEZ region,
34 potentially suitable habitat for this species does not occur in the area of direct effects. However,
35 approximately 9 mi (14 km) of potentially suitable aquatic habitat within the Gila River occurs
36 in the area of potential indirect effects; this area represents about 3.0% of the available suitable
37 habitat in the SEZ region (Table 8.3.12.1-1).

38
39 Aquatic habitats outside of the area of direct effects that may provide suitable habitat for
40 the roundtail chub may be dependent on surface discharges from the Lower Hassayampa River
41 Groundwater Basin and may be affected by groundwater withdrawals to serve development on
42 the Gillespie SEZ. As discussed for the southwestern willow flycatcher (Section 8.3.12.2.1),
43 impacts on this species could range from small to large depending upon the solar energy
44 technology deployed, the scale of development within the SEZ, and the cumulative rate of
45 groundwater withdrawals (Table 8.3.12.1-1).

1 The implementation of programmatic design features and avoidance or limitations of
2 groundwater withdrawals from the regional groundwater system could reduce impacts on the
3 roundtail chub to small or negligible levels. Impacts can be better quantified for specific projects
4 once water needs are identified.
5

6 7 **Lowland Leopard Frog** 8

9 Quad-level occurrences for the lowland leopard frog intersect the affected area of the
10 Gillespie SEZ. Approximately 288 acres (1 km²) of potentially suitable habitat on the SEZ and
11 2 acres (<0.1 km²) of potentially suitable habitat in the access road corridor could be directly
12 affected by construction and operations (Table 8.3.12.1-1). This direct impact area represents
13 about 0.1% of potentially suitable habitat in the SEZ region. About 7,480 acres (30 km²) of
14 potentially suitable habitat occurs in the area of indirect effects; this area represents about 3.0%
15 of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1).
16

17 Aquatic and riparian habitats outside of the area of direct effects that may provide
18 suitable habitat for the lowland leopard frog may be dependent on surface discharges from the
19 Lower Hassayampa River Groundwater Basin and may be affected by groundwater withdrawals
20 to serve development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher
21 (Section 8.3.12.2.1), impacts on this species could range from small to large depending upon the
22 solar energy technology deployed, the scale of development within the SEZ, and the cumulative
23 rate of groundwater withdrawals (Table 8.3.12.1-1).
24

25 The implementation of programmatic design features, avoiding or minimizing
26 disturbance to riparian habitats in the access road corridor, and avoidance or limitations of
27 groundwater withdrawals from the regional groundwater system could reduce impacts on the
28 lowland leopard frog to small or negligible levels. Impacts can be better quantified for specific
29 projects once water needs are identified. In addition, impacts could be reduced by conducting
30 pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area
31 of direct effects. If avoidance or minimization are not feasible options, individuals could be
32 translocated from the area of direct effects to protected areas that would not be affected directly
33 or indirectly by future development. Alternatively, or in combination with translocation, a
34 compensatory mitigation plan could be developed and implemented to mitigate direct effects on
35 occupied habitats. Compensation could involve the protection and enhancement of existing
36 occupied or suitable habitats to compensate for habitats lost to development. A comprehensive
37 mitigation strategy that used one or more of these options could be designed to completely offset
38 the impacts of development.
39

40 41 **Mexican Rosy Boa** 42

43 The Mexican rosy boa is known to occur within the SEZ region and potentially
44 suitable habitat is expected to occur in the affected area. Approximately 2,618 acres (11 km²)
45 of potentially suitable habitat on the SEZ and 20 acres (0.1 km²) of potentially suitable habitat
46 in the access road corridor could be directly affected by construction and operations

1 (Table 8.3.12.1-1). This direct impact area represents about 0.2% of potentially suitable
2 habitat in the SEZ region. About 84,700 acres (343 km²) of potentially suitable habitat
3 occurs in the area of indirect effects; this area represents about 2.2% of the potentially suitable
4 habitat in the SEZ region (Table 8.3.12.1-1).

5
6 The overall impact on the Mexican rosy boa from construction, operation, and
7 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is
8 considered small because the amount of potentially suitable foraging habitat for this species in
9 the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region.
10 The implementation of programmatic design features is expected to be sufficient to reduce
11 indirect impacts on this species to negligible levels.

12
13 Avoidance of all potentially suitable habitats to mitigate impacts on the Mexican rosy boa
14 is not feasible because potentially suitable desert scrub and wash habitats are widespread
15 throughout the area of direct effect. However, direct impacts could be reduced by conducting
16 pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area
17 of direct effects. If avoidance or minimization are not feasible options, individuals could be
18 translocated from the area of direct effects to protected areas that would not be affected directly
19 or indirectly by future development. Alternatively, or in combination with translocation, a
20 compensatory mitigation plan could be developed and implemented to mitigate direct effects on
21 occupied habitats. Compensation could involve the protection and enhancement of existing
22 occupied or suitable habitats to compensate for habitats lost to development. A comprehensive
23 mitigation strategy that used one or more of these options could be designed to completely offset
24 the impacts of development.

25 26 27 **Ferruginous Hawk**

28
29 The ferruginous hawk is a winter resident in the Gillespie SEZ region and potentially
30 suitable foraging habitat is expected to occur in the affected area. According to the SWReGAP
31 habitat suitability model, suitable habitat for this species does not occur within the area of direct
32 effects. However, about 10,600 acres (43 km²) of potentially suitable foraging habitat occurs in
33 the area of indirect effects; this area represents about 2.7% of the potentially suitable habitat in
34 the SEZ region (Table 8.3.12.1-1).

35
36 The overall impact on the ferruginous hawk from construction, operation, and
37 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
38 small because no potentially suitable habitat for this species occurs in the area of direct effects,
39 and only indirect effects are possible. The implementation of programmatic design features is
40 expected to be sufficient to reduce indirect impacts to negligible levels.

41 42 43 **Great Egret**

44
45 The great egret is a year-round resident in the Gillespie SEZ region and potentially
46 suitable habitat is expected to occur in the affected area. According to the SWReGAP habitat

1 suitability model, suitable aquatic and riparian habitat for this species does not occur in the area
2 of direct effects. However, approximately 1,000 acres (4 km²) of potentially suitable habitat
3 occurs in the area of indirect effects; this area represents about 3.5% of the potentially suitable
4 habitat in the SEZ region (Table 8.3.12.1-1). The majority of this suitable habitat occurs in
5 association with the Gila River east and southeast of the SEZ.
6

7 The great egret is not expected to occur in the area of direct effects. Aquatic and riparian
8 habitats outside of the area of direct effects that may provide suitable nesting and foraging
9 habitat for this species may be dependent on surface discharges from the Lower Hassayampa
10 River Groundwater Basin and may be affected by groundwater withdrawals to serve
11 development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher
12 (Section 8.3.12.2.1), impacts on this species could range from small to large depending upon the
13 solar energy technology deployed, the scale of development within the SEZ, and the cumulative
14 rate of groundwater withdrawals (Table 8.3.12.1-1).
15

16 The implementation of programmatic design features and avoidance or limitations of
17 groundwater withdrawals from the regional groundwater system could reduce impacts on the
18 great egret to small or negligible levels. Impacts can be better quantified for specific projects
19 once water needs are identified. In addition, avoiding or minimizing disturbance to riparian areas
20 within the access road corridor would further reduce impacts.
21

22 **Snowy Egret**

23 The snowy egret is a year-round resident in the Gillespie SEZ region and potentially
24 suitable habitat is expected to occur in the affected area. According to the SWReGAP habitat
25 suitability model, approximately 425 acres (2 km²) of potentially suitable habitat on the SEZ
26 and 3 acres (<0.1 km²) of potentially suitable habitat in the access road corridor could be directly
27 affected by construction and operations (Table 8.3.12.1-1). This direct impact area represents
28 0.1% of potentially suitable habitat in the SEZ region. Approximately 15,000 acres (61 km²) of
29 potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.2%
30 of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1). The majority of the
31 suitable habitat for this species occurs in association with the Gila River east and southeast of
32 the SEZ.
33
34
35

36 Aquatic and riparian habitats in the affected area that may provide suitable nesting and
37 foraging habitat for this species may be dependent on surface discharges from the Lower
38 Hassayampa River Groundwater Basin and may be affected by groundwater withdrawals to serve
39 development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher
40 (Section 8.3.12.2.1), impacts on this species could range from small to large depending upon the
41 solar energy technology deployed, the scale of development within the SEZ, and the cumulative
42 rate of groundwater withdrawals (Table 8.3.12.1-1).
43

44 The implementation of programmatic design features and avoidance or limitations of
45 groundwater withdrawals from the regional groundwater system could reduce impacts on the
46 snowy egret to small or negligible levels. Impacts can be better quantified for specific projects

1 once water needs are identified. In addition, avoiding or minimizing disturbance to riparian areas
2 within the SEZ and access road corridor would further reduce impacts.
3
4

5 **Western Burrowing Owl**

6

7 The western burrowing owl is a year-round resident in the Gillespie SEZ region and
8 potentially suitable foraging and nesting habitat is expected to occur in the affected area.
9 Approximately 2,618 acres (11 km²) of potentially suitable habitat on the SEZ and 20 acres
10 (0.1 km²) of potentially suitable habitat in the access road corridor could be directly affected
11 by construction and operations (Table 8.3.12.1-1). This direct impact area represents 0.1% of
12 potentially suitable habitat in the SEZ region. About 97,000 acres (393 km²) of potentially
13 suitable habitat occurs in the area of indirect effects; this area represents about 2.2% of the
14 potentially suitable habitat in the SEZ region (Table 8.3.12.1-1). Most of this area could serve
15 as foraging and nesting habitat (shrublands). The abundance of burrows suitable for nesting in
16 the affected area has not been determined.
17

18 The overall impact on the western burrowing owl from construction, operation, and
19 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
20 small because the amount of potentially suitable habitat for this species in the area of direct
21 effects represents less than 1% of potentially suitable habitat in the SEZ region. The
22 implementation of programmatic design features is expected to be sufficient to reduce indirect
23 impacts to negligible levels.
24

25 Avoidance of all potentially suitable habitats is not a feasible way to mitigate impacts on
26 the western burrowing owl because potentially suitable desert scrub habitats are widespread
27 throughout the area of direct effect and readily available in other portions of the SEZ region.
28 Impacts on the western burrowing owl could be reduced to negligible levels through the
29 implementation of programmatic design features and by conducting pre-disturbance surveys and
30 avoiding or minimizing disturbance to occupied burrows in the area of direct effects. If
31 avoidance or minimization are not feasible options, a compensatory mitigation plan could be
32 developed and implemented to mitigate direct effects on occupied habitats. Compensation could
33 involve the protection and enhancement of existing occupied or suitable habitats to compensate
34 for habitats lost to development. A comprehensive mitigation strategy that used one or both of
35 these options could be designed to completely offset the impacts of development. The need for
36 mitigation, other than programmatic design features, should be determined by conducting
37 pre-disturbance surveys for the species and its habitat in the area of direct effects.
38
39

40 **California Leaf-Nosed Bat**

41

42 The California leaf-nosed bat is a year-round resident within the Gillespie SEZ region.
43 On the basis of SWReGAP land cover data, suitable roosting habitats (caves and mines) do not
44 occur in the affected area. However, approximately 2,618 acres (11 km²) of potentially suitable
45 habitat on the SEZ and 21 acres (0.1 km²) of potentially suitable habitat in the access road
46 corridor could be directly affected by construction and operations (Table 8.3.12.1-1). This

1 direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. About
2 85,900 acres (348 km²) of potentially suitable foraging habitat occurs in the area of indirect
3 effect; this area represents about 2.2% of the available suitable foraging habitat in the region
4 (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP landcover types, there are no
5 potentially suitable roosting habitats (rocky cliffs and outcrops) in the affected area.
6

7 The overall impact on the California leaf-nosed bat from construction, operation, and
8 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
9 small because the amount of potentially suitable habitat for this species in the area of direct
10 effects represents less than 1% of potentially suitable habitat in the region. The implementation
11 of programmatic design features may be sufficient to reduce indirect impacts on this species to
12 negligible levels. Avoidance of all potentially suitable foraging habitats is not a feasible way to
13 mitigate impacts because potentially suitable habitat is widespread throughout the area of direct
14 effect and readily available in other portions of the SEZ region.
15

16 **Western Red Bat**

17
18
19 The western red bat is an uncommon year-round resident within the Gillespie SEZ
20 region. According to the SWReGAP habitat suitability model, potentially suitable habitat for
21 this species does not occur in the area of direct effects. However, about 625 acres (3 km²) of
22 potentially suitable foraging or roosting habitat occurs in the area of indirect effect; this area
23 represents about 3.6% of the available suitable foraging habitat in the region (Table 8.3.12.1-1).
24 On the basis of an evaluation of SWReGAP land cover types, there are no potentially suitable
25 roosting habitats (woodlands) in the area of direct effects. However, approximately 1,000 acres
26 (4 km²) of riparian woodlands that may be potentially suitable roosting habitat occurs in the area
27 of indirect effects.
28

29 The overall impact on the western red bat from construction, operation, and
30 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
31 small because no potentially suitable habitat for this species occurs in the area of direct effects,
32 and only indirect effects are possible. The implementation of programmatic design features is
33 expected to be sufficient to reduce indirect impacts to negligible levels.
34
35

36 **Western Yellow Bat**

37
38 The western yellow bat is an uncommon year-round resident within the Gillespie SEZ
39 region. According to the SWReGAP habitat suitability model, approximately 2,618 acres
40 (11 km²) of potentially suitable habitat on the SEZ and 20 acres (0.1 km²) of potentially suitable
41 habitat in the access road corridor could be directly affected by construction and operations
42 (Table 8.3.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the
43 SEZ region. About 87,500 acres (354 km²) of potentially suitable foraging habitat occurs in the
44 area of indirect effect; this area represents about 2.0% of the available suitable foraging habitat
45 in the region (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types,
46 there are no potentially suitable roosting habitats (woodlands) in the area of direct effects.

1 However, approximately 1,000 acres (4 km²) of riparian woodlands that may be potentially
2 suitable roosting habitat occurs in the area of indirect effects.

3
4 The overall impact on the western yellow bat from construction, operation, and
5 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
6 small because the amount of potentially suitable habitat for this species in the area of direct
7 effects represents less than 1% of potentially suitable foraging habitat in the region. The
8 implementation of programmatic design features may be sufficient to reduce indirect impacts on
9 this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a
10 feasible way to mitigate direct impacts because potentially suitable habitat is widespread
11 throughout the area of direct effect and readily available in other portions of the SEZ region.

12 13 14 **8.3.12.2.5 Impacts on State-Listed Species**

15
16 There are a total of 18 species listed by the State of Arizona that may occur in the
17 Gillespie SEZ affected area (Table 8.3.12.1-1). Of these species, impacts to the following 3 state-
18 listed species have not been previously described: California barrel cactus, straw-top cholla, and
19 western snowy plover. Impacts on each of these 3 species are discussed below and summarized
20 in Table 8.3.12.1-1.

21 22 23 **California Barrel Cactus**

24
25 The California barrel cactus is known to occur in the affected area of the Gillespie SEZ
26 on the basis of quad-level occurrences for the species. According to the SWReGAP land cover
27 model, potentially suitable desert riparian habitat for this species does not occur on the SEZ.
28 However, approximately 2 acres (<0.1 km²) of potentially suitable desert wash or riparian
29 habitat does occur in the assumed access road corridor (Table 8.3.12.1-1). This direct effects
30 area represents less than 0.1 % of available suitable habitat in the region. About 2,000 acres
31 (8 km²) of potentially suitable desert wash or riparian habitat occurs in the area of potential
32 indirect effects; this area represents about 3.9% of the available suitable habitat in the SEZ
33 region (Table 8.3.12.1-1).

34
35 The overall impact on the California barrel cactus from construction, operation, and
36 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
37 small because less than 1% of potentially suitable habitat for this species occurs in the area of
38 direct effects. The implementation of programmatic design features is expected to be sufficient to
39 reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to riparian
40 habitats in the assumed access road corridor and the implementation of other mitigation
41 measures described previously for the Hohokam agave (Section 8.3.12.2.4) could reduce direct
42 impacts on this species to negligible levels. The need for mitigation, other than programmatic
43 design features, should be determined by conducting pre-disturbance surveys for the species and
44 its habitat in the area of direct effects.

1 **Straw-Top Cholla**

2
3 The straw-top cholla is known to occur in the affected area of the Gillespie SEZ on the
4 basis of quad-level occurrences for the species. According to the SWReGAP land cover model,
5 potentially suitable desert riparian habitat for this species does not occur on the SEZ. However,
6 approximately 2 acres (<0.1 km²) of potentially suitable desert wash or riparian habitat does
7 occur in the assumed access road corridor (Table 8.3.12.1-1). This direct effects area represents
8 less than 0.1 % of available suitable habitat in the region. About 2,000 acres (8 km²) of
9 potentially suitable desert wash or riparian habitat occurs in the area of potential indirect effects;
10 this area represents about 3.9% of the available suitable habitat in the SEZ region
11 (Table 8.3.12.1-1).

12
13 The overall impact on the straw-top cholla from construction, operation, and
14 decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered
15 small because less than 1% of potentially suitable habitat for this species occurs in the area of
16 direct effects. The implementation of programmatic design features is expected to be sufficient to
17 reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to riparian
18 habitats in the assumed access road corridor and the implementation of other mitigation
19 measures described previously for the Hohokam agave (Section 8.3.12.2.4) could reduce direct
20 impacts on this species to negligible levels. The need for mitigation, other than programmatic
21 design features, should be determined by conducting pre-disturbance surveys for the species and
22 its habitat on the SEZ.

23
24
25 **Western Snowy Plover**

26
27 The western snowy plover is known throughout the western United States and breeds
28 on alkali flats around reservoirs and sandy shorelines. According to the SWReGAP habitat
29 suitability model, suitable aquatic and riparian habitat for this species does not occur in the area
30 of direct effects. However, approximately 1,100 acres (4 km²) of potentially suitable habitat
31 occurs in the area of indirect effects; this area represents about 0.3% of the potentially suitable
32 habitat in the SEZ region (Table 8.3.12.1-1). The majority of the suitable habitat for this species
33 occurs in association with the Gila River east and southeast of the SEZ.

34
35 The western snowy plover is not expected to occur in the area of direct effects. The
36 overall impact on the western snowy plover from construction, operation, and decommissioning
37 of utility-scale solar energy facilities within the Gillespie SEZ is considered small because no
38 potentially suitable habitat for this species occurs in the area of direct effects, and only indirect
39 effects are possible. The implementation of programmatic design features is expected to be
40 sufficient to reduce indirect impacts to negligible levels.

41
42
43 **8.3.12.2.6 Impacts on Rare Species**

44
45 There are 22 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern
46 by the USFWS) that may be affected by solar energy development on the Gillespie SEZ

1 (Table 8.3.12.1-1). Impacts to 8 rare species have not been discussed previously. These include
2 the following (1) plants: arid tansy-aster and California snakewood; (2) invertebrates: Maricopa
3 tiger beetle; (3) amphibians: Arizona toad; (4) reptiles: Gila monster; (5) birds: cattle egret
4 and long-eared owl; and (6) mammals: cave myotis. Impacts on these species are presented in
5 Table 8.3.12.1-1.
6
7

8 **8.3.12.3 SEZ-Specific Design Features and Design Feature Effectiveness**

9

10 The implementation of required programmatic design features described in Appendix A
11 would greatly reduce or eliminate the potential for effects of utility-scale solar energy
12 development on special status species. While some SEZ-specific design features are best
13 established when specific project details are being considered, some design features can be
14 identified at this time, including the following:
15

- 16 • Pre-disturbance surveys should be conducted within the SEZ and access road
17 corridor to determine the presence and abundance of special status species,
18 including those identified in Table 8.3.12.1-1; disturbance to occupied habitats
19 for these species should be avoided or minimized to the extent practicable. If
20 avoiding or minimizing impacts to occupied habitats is not possible,
21 translocation of individuals from areas of direct effect, or compensatory
22 mitigation of direct effects on occupied habitats could reduce impacts. A
23 comprehensive mitigation strategy for special status species that used one or
24 more of these options to offset the impacts of development should be
25 developed in coordination with the appropriate federal and state agencies.
26
- 27 • Consultation with the USFWS and AZGFD should be conducted to address
28 the potential for impacts on the following species currently listed as
29 threatened or endangered under the ESA: Sonoran bald eagle, southwestern
30 willow flycatcher, and Yuma clapper rail. Consultation would identify an
31 appropriate survey protocol, avoidance and minimization measures, and, if
32 appropriate, reasonable and prudent alternatives, reasonable and prudent
33 measures, and terms and conditions for incidental take statements (if
34 necessary).
35
- 36 • Coordination with the USFWS and AZGFD should be conducted to address
37 the potential for impacts on the following species that are candidates or under
38 review for listing under the ESA: Sonoran desert tortoise, Tucson shovel-
39 nosed snake, and western yellow-billed cuckoo. The Sonoran desert tortoise
40 is a species under review for listing under the ESA; the Tucson shovel-nosed
41 snake and western yellow-billed cuckoo are candidates for listing under the
42 ESA. Coordination would identify an appropriate survey protocol, and
43 mitigation, which may include avoidance, minimization, translocation, or
44 compensation.
45

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- Avoiding or minimizing disturbance to desert riparian habitat within the assumed access road corridor could reduce or eliminate impacts to the following 17 special status species: Arid tansy-aster, California barrel cactus, California snakewood, Hohokam agave, straw-top cholla, Tumamoc globeberry, Maricopa tiger beetle, Arizona toad, lowland leopard frog, cattle egret, great egret, snowy egret, southwestern willow flycatcher, western yellow-billed cuckoo, Yuma clapper rail, and western yellow bat.
 - Avoidance or minimization of groundwater withdrawals to serve solar energy development on the SEZ could reduce or eliminate impacts to the following 9 special status species with habitats dependent upon groundwater discharge in the SEZ region: roundtail chub, Arizona toad, lowland leopard frog, cattle egret, great egret, snowy egret, southwestern willow flycatcher, western yellow-billed cuckoo, and Yuma clapper rail. In particular, impacts to aquatic and riparian habitat associated with the Gila River should be avoided.
 - Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and AZGFD.

22

23

If these SEZ-specific design features are implemented in addition to required programmatic design features, impacts on the special status and rare species could be reduced.

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1 **8.3.13 Air Quality and Climate**

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3
4 **8.3.13.1 Affected Environment**

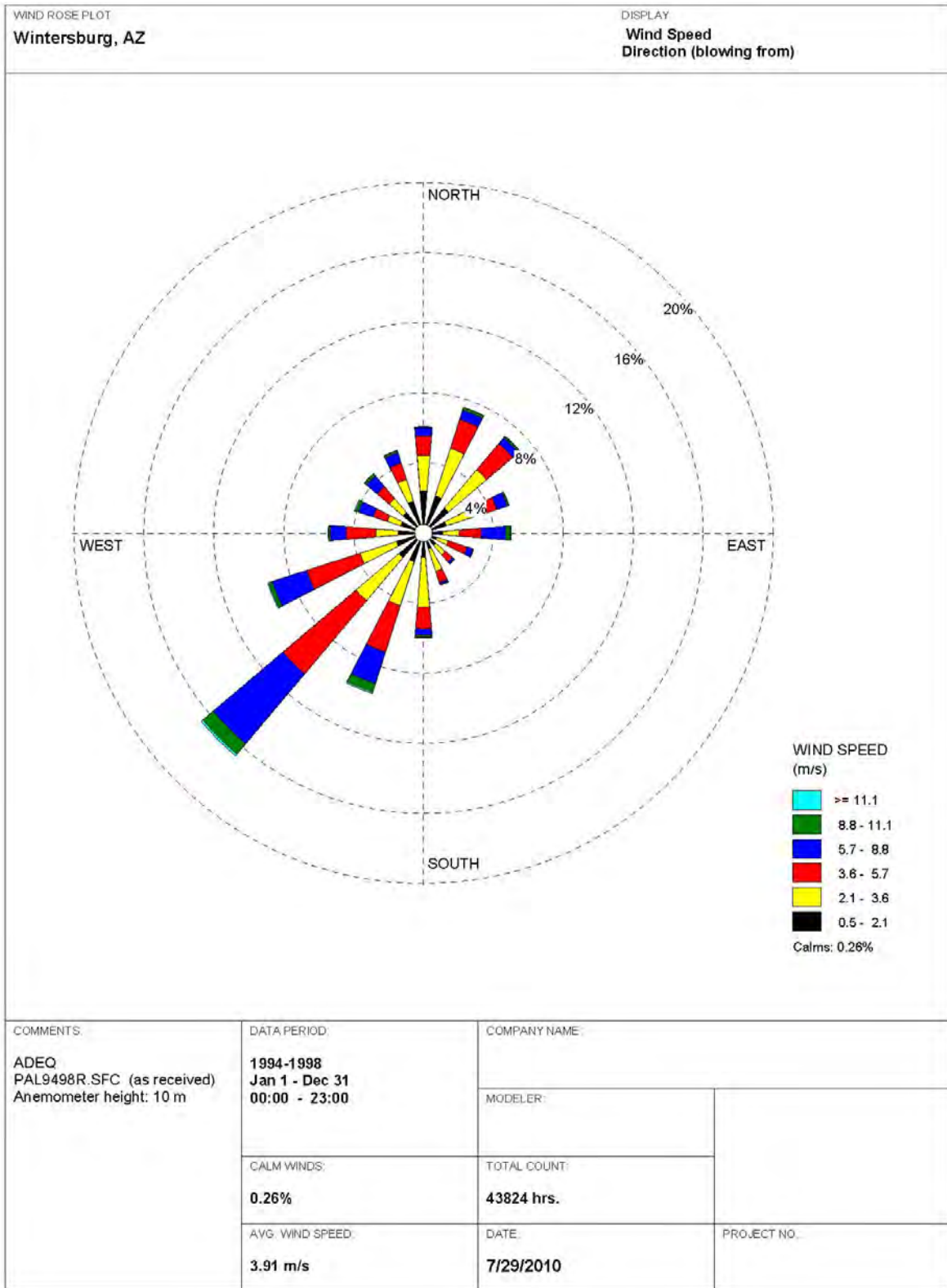
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6
7 **8.3.13.1.1 Climate**

8
9 The proposed Gillespie SEZ is located in the west-central portion of Maricopa County in
10 south-central Arizona. At an average elevation of 930 ft (284 m), the SEZ is located on relatively
11 flat terrain, gently sloping downward to the northeast and scattered by low hills and buttes
12 mostly to the south. The SEZ is in the northern portion of the Sonoran Desert, which covers
13 southwest Arizona, southern California, and northwestern Mexican states. The area experiences
14 a desert-like arid climate, characterized by hot summers, mild winters, light precipitation, a high
15 rate of evaporation, low relative humidity, abundant sunshine, and large temperature ranges
16 (NCDC 2010a). Meteorological data collected at Wintersburg, about 8 mi (13 km) north of the
17 Gillespie SEZ, and at Tonopah, about 13 mi (21 km) north–northwest, are summarized below.
18

19 A wind rose from Wintersburg, for the 5-year period 1994 to 1998, taken at a level of
20 33 ft (10 m), is presented in Figure 8.3.13.1-1 (Mao 2010). During this period, the annual
21 average wind speed at the airport was about 8.7 mph (3.9 m/s); the prevailing wind direction was
22 from the southwest (about 16.6% of the time) and secondarily from the south–southwest (about
23 9.6% of the time) and the west–southwest (about 9.3% of the time). Winds blew more frequently
24 from the southwest from March to October and from the north–northeast from November to
25 February. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred infrequently
26 (about 0.3% of the time). Average wind speeds by season were the highest in summer at 9.9 mph
27 (4.4 m/s); lower in spring and fall at 9.7 mph (4.3 m/s) and 7.9 mph (3.5 m/s), respectively; and
28 lowest in winter at 7.4 mph (3.3 m/s).
29

30 Topography plays a large role in determining the temperature of any specific location in
31 Arizona. For the 1951 to 2010 period, the annual average temperature at Tonopah was 70.4°F
32 (21.3°C) (WRCC 2010a). January was the coldest month, with an average minimum temperature
33 of 36.5°F (2.5°C) in December, and July was the warmest month, with an average maximum of
34 106.8°F (41.6°C). In summer, daytime maximum temperatures higher than 100°F (37.8°C) were
35 common, and minimums were in the 70s. The minimum temperatures recorded were below
36 freezing ($\leq 32^{\circ}\text{F}$ [0°C]) during the colder months (about 9 days in December and January),
37 but subzero temperatures have never been recorded. During the same period, the highest
38 temperature, 121°F (49.4°C), was reached in June 1990, and the lowest, 14°F (–10.0°C), in
39 December 1990. In a typical year, about 168 days had a maximum temperature of $\geq 90^{\circ}\text{F}$
40 (32.2°C), while about 25 days had minimum temperatures at or below freezing.
41

42 Throughout Arizona, precipitation patterns largely depend on elevation and the season of
43 the year. In Arizona, rain comes mostly in two distinct seasons (winter and summer monsoon
44 season) (NCDC 2010a). For the 1951 to 2010 period, annual precipitation at Tonopah averaged
45 about 7.60 in. (19.3 cm) (WRCC 2010a). On average, there are 24 days annually with
46 measurable



1

2

3

FIGURE 8.3.13.1-1 Wind Rose at 33 ft (10 m) at Wintersburg, Arizona, 1994 to 1998
(Source: Mao 2010)

1 precipitation (0.01 in. [0.025 cm] or higher). Seasonally, precipitation is the highest in winter and
2 the lowest in spring. No snowfall at Tonopah has been reported.

3
4 The proposed Gillespie SEZ is far from major water bodies (about 130 mi [210 km] to
5 the Gulf of California). Severe weather events, such as floods, hail, and thunderstorm winds,
6 have been reported in Maricopa County, which encompasses the Gillespie SEZ (NCDC 2010b).

7
8 In Arizona, flood conditions occur infrequently, but heavy thunderstorms during the
9 summer thunderstorm season at times cause floods that do considerable local damage. Since
10 1993, 93 floods (three-fourths of which were flash floods) were reported in Maricopa County,
11 most of which occurred far from the SEZ. These floods caused seven deaths, three injuries, and
12 considerable property and crop damage.

13
14 In Maricopa County, 109 hail events have been reported since 1960, which occurred
15 more frequently from August to October and caused no deaths but resulted in three injuries and
16 some property damage. Hail size of 2.75 in. (7.0 cm) in diameter was reported in 1990. Since
17 1955, 631 thunderstorm winds have been reported, and those up to a maximum wind speed of
18 115 mph (51 m/s) occurred mostly during summer months and caused 2 deaths, 80 injuries, and
19 considerable property damage (NCDC 2010b).

20
21 Eight dust storm events have been reported in Maricopa County since 1994
22 (NCDC 2010b). The ground surface of the SEZ is covered predominantly with gravelly sandy
23 loams, which have moderate dust storm potential. On occasion, high winds accompanied by
24 thunderstorms and dry soil conditions could result in blowing dust in Maricopa County. Dust
25 storms can deteriorate air quality and visibility and have adverse effects on health.

26
27 Hurricanes and tropical storms formed off the coast of Central America and Mexico
28 weaken over the cold waters off the California coast. Accordingly, hurricanes rarely hit Arizona
29 through California. Historically, one tropical storm/depression from the Gulf of California
30 passed within 100 mi (160 km) of the proposed Gillespie SEZ (CSC 2010). In the period from
31 1950 to April 2010, 57 tornadoes (1 per year each) were reported in Maricopa County
32 (NCDC 2010b). Most tornadoes occurring in Maricopa County were relatively weak (i.e., 7 were
33 F [uncategorized⁷]; 23 were F0; 20 were F1; 6 were F2; and 1 was F3 on the Fujita tornado
34 scale), and these tornadoes caused no deaths but resulted in 57 injuries and considerable property
35 damage. Several of these tornadoes occurred not far from the SEZ, the nearest one of which hit
36 the area about 5 mi (8 km) southeast of the SEZ.

37 38 39 **8.3.13.1.2 Existing Air Emissions**

40
41 Maricopa County has many industrial emission sources, mostly in and around Phoenix.
42 Several power-generating plants (Palo Verde Nuclear Generating Station and three natural gas-
43 fired power plants) and a compressor station are located north and east of the SEZ, but their
44 emissions are relatively small. Several major roads exist in Maricopa County, such as I-8, I-10,

⁷ Not categorized by the Fujita tornado scale because damage level was not reported.

1 I-17, U.S. 60, and many state routes. Thus, onroad mobile source emissions are substantial
 2 compared with emissions from other sources in Maricopa County. Data on annual emissions
 3 of criteria pollutants and VOCs in Maricopa County are presented in Table 8.3.13.1-1 for 2002
 4 (WRAP 2009). Emission data are classified into six source categories: point, area (including
 5 fugitive dust), onroad mobile, nonroad mobile, biogenic, and fire (wildfires, prescribed fires,
 6 agricultural fires, structural fires). In 2002, onroad sources
 7 were major contributors to total SO₂, NO_x, and CO emissions
 8 (about 48%, 71%, and 49%, respectively). Biogenic sources
 9 (i.e., vegetation—including trees, plants, and crops—and soils)
 10 that release naturally occurring emissions accounted for about
 11 two-thirds of the VOC emissions (about 67%). Area sources
 12 accounted for about 81% of PM₁₀ and 61% of PM_{2.5}. In
 13 Maricopa County, nonroad sources were secondary contributors
 14 to SO₂, NO_x, CO, and PM_{2.5} emissions. Point sources were
 15 minor contributors to criteria pollutants and VOCs, while fire
 16 sources were insignificant contributors.

17
 18 In 2010, Arizona is projected to produce about
 19 116.6 MMt of *gross*⁸ carbon dioxide equivalent (CO_{2e})⁹
 20 emissions, which is about 1.6% of total U.S. GHG emissions
 21 in 2007 (Bailie et al. 2005). Gross GHG emissions in Arizona
 22 increased by about 77% from 1990 to 2010 because of
 23 Arizona’s rapid population growth and attendant economic
 24 growth, compared to 16% growth in U.S. GHG emissions
 25 during the 1990 to 2005 period. In 2005, electricity use (about
 26 40.0%) and transportation (about 38.9%) were the primary
 27 contributors to gross GHG emission sources in Arizona. Fuel
 28 use in the residential, commercial, and industrial (RCI) sectors
 29 combined accounted for about 15.4% of total state emissions.
 30 Arizona’s *net* emissions were about 109.9 MMt CO_{2e},
 31 considering carbon sinks from forestry activities and
 32 agricultural soils throughout the state. The EPA (2009b) also
 33 estimated 2005 emissions in Arizona. Its estimate of CO₂
 34 emissions from fossil fuel combustion was 97.2 MMt, which
 35 was comparable to the state’s estimate. Electric power
 36 generation and transportation accounted for about 51.8% and
 37 38.8% of the CO₂ emissions total, respectively, while the RCI
 38 sectors accounted for the remainder (about 9.4%).
 39

TABLE 8.3.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Maricopa County, Arizona, Encompassing the Proposed Gillespie SEZ, 2002^a

Pollutant	Emissions (tons/yr)
SO ₂	2,538
NO _x	118,816
CO	792,331
VOCs	379,411
PM ₁₀	35,459
PM _{2.5}	13,702

^a Includes point, area (including fugitive dust), onroad and nonroad mobile, biogenic, and fire emissions.

^b Notation: CO = carbon monoxide; NO_x = nitrogen oxides; PM_{2.5} = particulate matter with a diameter of ≤2.5 μm; PM₁₀ = particulate matter with a diameter of ≤10 μm; SO₂ = sulfur dioxide; and VOC = volatile organic compounds.

Source: WRAP (2009).

⁸ Excluding GHG emissions removed as a result of forestry and other land uses and excluding GHG emissions associated with exported electricity.

⁹ A measure used to compare the emissions from various GHGs on the basis of their global warming potential, defined as the cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas, CO₂. The CO_{2e} for a gas is derived by multiplying the mass of the gas by the associated global warming potential.

1 **8.3.13.1.3 Air Quality**
2

3 The State of Arizona has adopted the NAAQS for six criteria pollutants: SO₂, NO₂, CO,
4 O₃, PM (PM₁₀ and PM_{2.5}), and Pb (ADEQ 2009; EPA 2010a). The NAAQS for criteria
5 pollutants is presented in Table 8.3.13.1-2.
6

7 Maricopa County is located administratively within the Maricopa Intrastate AQCR
8 (Title 40, Part 81, Section 36 of the *Code of Federal Regulations* [40 CFR 81.36]). Currently, the
9 Maricopa AQCR is designated by the U.S. EPA as a nonattainment area for 8-hour O₃ and PM₁₀
10 and as a maintenance area for CO. The Gillespie SEZ is located far outside of the PM₁₀
11 nonattainment area and CO maintenance area but just outside of the 8-hour O₃ nonattainment
12 area (ADEQ 2010a). Maricopa County is designated as an unidentifiable/attainment area for all
13 other criteria pollutants (40 CFR 81.303).
14

15 Because of relatively high population density and many industrial activities, Maricopa
16 County has many significant industrial emission sources of its own, but mobile emissions along
17 major highways account for considerable NO_x and CO emissions. Outside urban areas, ambient
18 air quality in Maricopa County is relatively good, except for O₃ and PM. Currently, more than
19 20 air monitoring stations are established in downtown Phoenix and the surrounding areas in
20 Maricopa County. Buckeye, about 15 mi (24 km) east–northeast of the Gillespie SEZ, is the
21 nearest air monitoring station where NO₂, CO, O₃, and PM₁₀ are monitored. To characterize
22 ambient air quality for SO₂ and PM_{2.5} around the SEZ, the two closest monitoring stations
23 located in the Phoenix area were chosen. For SO₂ and PM_{2.5}, the highest concentrations at two
24 monitoring stations in the Phoenix area, which are about 47 mi (76 km) and 43 mi (69 km) east–
25 northeast of the SEZ, respectively, were presented. No Pb measurements have been made in the
26 state of Arizona because of low Pb concentration levels after the phaseout of leaded gasoline.
27 The highest background concentrations of criteria pollutants at these stations for the period 2004
28 to 2008 are presented in Table 8.3.13.1-2 (EPA 2010b). The highest concentration levels were
29 lower than their respective standards (up to 23%), except O₃, PM₁₀, and PM_{2.5}, which
30 approached or exceeded their respective NAAQS. These criteria pollutants are of regional
31 concern in the area because of high temperatures, abundant sunshine, and windblown dust from
32 occasional high winds and dry soil conditions.
33

34 The PSD regulations (see 40 CFR 52.21), which are designed to limit the growth of air
35 pollution in clean areas, apply to a major new source or modification of an existing major
36 source within an attainment or unclassified area (see Section 4.11.2.3). As a matter of policy,
37 EPA recommends that the permitting authority notify the Federal Land Managers when a
38 proposed PSD source would locate within 62 mi (100 km) of a sensitive Class I area. There
39 are several Class I areas around the Gillespie SEZ, none of which is situated within the 62-mi
40 (100-km) distance in Arizona. The nearest Class I area is Superstition WA (40 CFR 81.403),
41 about 79 mi (127 km) east of the Gillespie SEZ. This Class I area is not located downwind of
42 prevailing winds at the Gillespie SEZ (Figure 8.3.13.1-1). The next nearest Class I areas include
43 Mazatzal WA and Pine Mountain WA, which are about 84 mi (135 km) and 89 mi (143 km)
44 northeast of the SEZ, respectively.
45
46

**TABLE 8.3.13.1-2 NAAQS and Background Concentration Levels
Representative of the Proposed Gillespie SEZ in Maricopa County, Arizona,
2004 to 2008**

Pollutant ^a	Averaging Time	NAAQS	Background Concentration Level	
			Concentration ^{b,c}	Measurement Location, Year
SO ₂	1-hour	75 ppb ^d	– ^e	–
	3-hour	0.5 ppm	0.013 ppm (2.6%)	Phoenix, Maricopa County, 2007
	24-hour	0.14 ppm	0.008 ppm (5.7%)	Phoenix, Maricopa County, 2004
	Annual	0.030 ppm	0.003 ppm (10%)	Phoenix, Maricopa County, 2004
NO ₂	1-hour	100 ppb ^f	–	–
	Annual	0.053 ppm	0.012 ppm (23%)	Buckeye, Maricopa County, 2005
CO	1-hour	35 ppm	1.6 ppm (4.6%)	Buckeye, Maricopa County, 2007
	8-hour	9 ppm	0.9 ppm (10%)	Buckeye, Maricopa County, 2005
O ₃	1-hour	0.12 ppm ^g	0.080 ppm (67%)	Buckeye, Maricopa County, 2006
	8-hour	0.075 ppm	0.068 ppm (91%)	Buckeye, Maricopa County, 2008
PM ₁₀	24-hour	150 µg/m ³	204 µg/m ³ (136%)	Buckeye, Maricopa County, 2008
	Annual	50 µg/m ³ ^h	53 µg/m ³ (106%)	Buckeye, Maricopa County, 2007
PM _{2.5}	24-hour	35 µg/m ³	42.3 µg/m ³ (121%)	Phoenix, Maricopa County, 2005
	Annual	15.0 µg/m ³	13.5 µg/m ³ (90%)	Phoenix, Maricopa County, 2006
Pb	Calendar quarter	1.5 µg/m ³	–	–
	Rolling 3-month	0.15 µg/m ³ ⁱ	–	–

^a Notation: CO = carbon monoxide; NO₂ = nitrogen dioxide; O₃ = ozone; Pb = lead; PM_{2.5} = particulate matter with a diameter of ≤2.5 µm; PM₁₀ = particulate matter with a diameter of ≤10 µm; SO₂ = sulfur dioxide.

^b Monitored concentrations are the second-highest for all averaging times less than or equal to 24-hour averages, except fourth-highest daily maximum for 8-hour O₃ and the 98th percentile for 24-hour PM_{2.5}; and arithmetic mean for annual SO₂, NO₂, PM₁₀, and PM_{2.5}.

^c Values in parentheses are background concentration levels as a percentage of NAAQS. Calculation of 1-hour SO₂ and NO₂ to NAAQS was not made, because no measurement data based on new NAAQS are available.

^d Effective August 23, 2010.

^e A dash indicates not applicable or not available.

^f Effective April 12, 2010.

^g The EPA revoked the 1-hour O₃ standard in all areas, although some areas have continuing obligations under that standard (“anti-backsliding”).

^h Effective December 18, 2006, the EPA revoked the annual PM₁₀ standard of 50 µg/m³ but annual PM₁₀ concentrations are presented for comparison purposes.

ⁱ Effective January 12, 2009.

Sources: ADEQ (2009); EPA (2010a,b).

1 **8.3.13.2 Impacts**
2

3 Potential impacts on ambient air quality associated with a solar project would be of
4 most concern during the construction phase. Impacts on ambient air quality from fugitive dust
5 emissions resulting from soil disturbances are anticipated, but they would be of short duration.
6 During the operations phase, only a few sources with generally low-level emissions would exist
7 for any of the four types of solar technologies evaluated. A solar facility would either not burn
8 fossil fuels or burn only small amounts during operation. (For facilities using HTFs, fuel could
9 be used to maintain the temperature of the HTFs for more efficient daily start-up.) Conversely,
10 solar facilities would displace air emissions that would otherwise be released from fossil fuel
11 power plants.
12

13 Air quality impacts shared by all solar technologies are discussed in detail in
14 Section 5.11.1, and technology-specific impacts are discussed in Section 5.11.2. Impacts specific
15 to the proposed Gillespie SEZ are presented in the following sections. Any such impacts would
16 be minimized through the implementation of required programmatic design features described in
17 Appendix A, Section A.2.2, and through any additional mitigation applied. Section 8.3.13.3
18 below identifies SEZ-specific design features of particular relevance to the Gillespie SEZ.
19
20

21 **8.3.13.2.1 Construction**
22

23 The Gillespie SEZ has a relatively flat terrain; thus only a minimum number of site
24 preparation activities, perhaps with no large-scale earthmoving operations, would be required.
25 However, fugitive dust emissions from soil disturbances during the entire construction phase
26 would be a major concern because of the large areas that would be disturbed in a region with
27 windblown dust problems. Fugitive dusts, which are released near ground level, typically have
28 more localized impacts than similar emissions from an elevated stack with additional plume rise
29 induced by buoyancy and momentum effects.
30
31

32 **Methods and Assumptions**
33

34 Air quality modeling for PM₁₀ and PM_{2.5} emissions associated with construction
35 activities was performed using the EPA-recommended AERMOD model (EPA 2009c). Details
36 for emissions estimation, the description of AERMOD, input data processing procedures, and
37 modeling assumption are described in Section M.13 of Appendix M. Estimated air
38 concentrations were compared with the applicable NAAQS levels at the site boundaries and
39 nearby communities and with Prevention of Significant Deterioration (PSD) increment levels at
40 nearby Class I areas.¹⁰ However, no receptors were modeled for PSD analysis at the nearest

¹⁰ To provide a quantitative assessment, the modeled air impacts of construction were compared to the NAAQS levels and the PSD Class I increment levels. Although the Clean Air Act exempts construction activities from PSD requirements, a comparison with the Class I increment levels was used to quantify potential impacts. Only monitored data can be used to determine the attainment status. Modeled data are used to assess potential problems and as a consideration in the permitting process.

1 Class I area, Superstition WA, because it is about 79 mi (127 km) from the SEZ, which is over
2 the maximum modeling distance of 31 mi (50 km) for the AERMOD. Rather, several regularly
3 spaced receptors in the direction of the Superstition WA were selected as surrogates for the PSD
4 analysis. For the Gillespie SEZ, the modeling was conducted based on the following assumptions
5 and input:
6

- 7 • It was assumed that 80% of the 2,618-acre (10.6-km²) area would be
8 disturbed within the SEZ in the peak construction year. Emissions were
9 modeled for a disturbance of 2,094 acres (8.5 km²) uniformly distributed over
10 the entire SEZ.
- 11 • Surface hourly meteorological data came from Phoenix Sky Harbor
12 International Airport, upper air sounding data from Tucson, and onsite data
13 from Wintersburg for the 1994 to 1998 period (Mao 2010).
- 14 • A receptor grid was spaced regularly over a modeling domain of
15 62 mi × 62 mi (100 km × 100 km) centered on the proposed SEZ, and
16 additional discrete receptors were present at the SEZ boundaries.
17
18
19
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21 **Results**

22
23 The modeling results for concentration increments and total concentrations (modeled plus
24 background concentrations) for both PM₁₀ and PM_{2.5} that would result from construction-related
25 fugitive emissions are summarized in Table 8.3.13.2-1. Maximum 24-hour PM₁₀ concentration
26 increments modeled to occur at the site boundaries would be an estimated 683 µg/m³, which
27 far exceeds the relevant standard level of 150 µg/m³. Total 24-hour PM₁₀ concentrations of
28 887 µg/m³ would also exceed the standard level at the SEZ boundary. However, high PM₁₀
29 concentrations would be limited to the immediate areas surrounding the SEZ boundary and
30 would decrease quickly with distance. Predicted maximum 24-hour PM₁₀ concentration
31 increments would be about 65 µg/m³ at the nearby residences about 4.1 mi (6.6 km) southeast of
32 the SEZ, about 40 µg/m³ at the nearest receptors about 1.8 mi (2.9 km) east of the SEZ, about
33 20 µg/m³ at Arlington, about 15 µg/m³ at Palo Verde and Wintersburg, and about 10 µg/m³ at
34 Buckeye and Gila Bend. Annual average modeled concentration increments and total
35 concentrations (increment plus background) for PM₁₀ at the SEZ boundary would be about
36 135 µg/m³ and 188 µg/m³, respectively, which are higher than the NAAQS level of 50 µg/m³,
37 which was revoked by the EPA in December 2006. Annual PM₁₀ increments would be much
38 lower, about 2.0 µg/m³ at the nearby residences about 3 mi (5 km) north of the SEZ, about
39 0.8 µg/m³ at Arlington, about 0.4 µg/m³ at Palo Verde and Wintersburg, and less than 0.3 µg/m³
40 at Buckeye and Gila Bend.

TABLE 8.3.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Gillespie SEZ

Pollutant ^a	Averaging Time	Rank ^b	Concentration ($\mu\text{g}/\text{m}^3$)				Percentage of NAAQS	
			Maximum Increment ^b	Background ^c	Total	NAAQS	Increment	Total
PM ₁₀	24 hours	H6H	683	204	887	150	455	591
	Annual	– ^d	135	53.0	188	50	269	375
PM _{2.5}	24 hours	H8H	48.2	42.3	90.5	35	138	258
	Annual	–	13.5	13.5	27.0	15.0	90	180

^a PM_{2.5} = particulate matter with a diameter of $\leq 2.5 \mu\text{m}$; PM₁₀ = particulate matter with a diameter of $\leq 10 \mu\text{m}$.

^b Concentrations for attainment demonstration are presented. H6H = highest of the sixth-highest concentrations at each receptor over the 5-yr period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-yr period. For the annual average, multiyear averages of annual means over the 5-yr period are presented. Maximum concentrations are predicted to occur at the site boundaries.

^c See Table 8.3.13.1-2.

^d Not applicable.

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Total 24-hour PM_{2.5} concentrations would be $90.5 \mu\text{g}/\text{m}^3$ at the SEZ boundary, which is higher than the NAAQS level of $35 \mu\text{g}/\text{m}^3$; modeled increments contribute about the same as background concentration to this total. The total annual average PM_{2.5} concentration would be $27.0 \mu\text{g}/\text{m}^3$, which exceeds the NAAQS level of $15.0 \mu\text{g}/\text{m}^3$. At the nearby residences about 3 mi (5 km) north of the SEZ, predicted maximum 24-hour and annual PM_{2.5} concentration increments would be about of about 2.0 and $0.2 \mu\text{g}/\text{m}^3$, respectively.

Predicted 24-hour and annual PM₁₀ concentration increments at the surrogate receptors for the nearest Class I Area—Superstition WA—would be about 6.7 and $0.21 \mu\text{g}/\text{m}^3$, or 84% and 5.2% of the PSD increments for the Class I area, respectively. These surrogate receptors are more than 48 mi (77 km) from the Superstition WA, and thus predicted concentrations in Superstition WA would be much lower than the above values (about 33% of the PSD increments for 24-hour PM₁₀), considering the same decay ratio with distance.

In conclusion, predicted 24-hour and annual PM₁₀ and PM_{2.5} concentration levels could exceed the standard levels at the SEZ boundaries and in the immediate surrounding areas during the construction of solar facilities. To reduce potential impacts on ambient air quality and in compliance with programmatic design features, aggressive dust control measures would be used. Potential air quality impacts on nearby communities would be much lower. Modeling indicates that emissions from construction activities are not anticipated to exceed Class I PSD PM₁₀ increments at the nearest federal Class I area (Superstition WA). Construction activities are not

1 subject to the PSD program, and the comparison provides only a screen for gauging the size of
2 the impact. Accordingly, it is anticipated that impacts of construction activities on ambient air
3 quality would be moderate and temporary.
4

5 Construction emissions from the engine exhaust from heavy equipment and vehicles have
6 the potential to affect AQRVs (e.g., visibility and acid deposition) at the nearby federal Class I
7 area. However, SO_x emissions from engine exhaust would be very low, because programmatic
8 design features would require ultra-low-sulfur fuel with a sulfur content of 15 ppm. NO_x
9 emissions from engine exhaust would be primary contributors to potential impacts on AQRVs.
10 Construction-related emissions are temporary in nature and thus would cause some unavoidable
11 but short-term impacts.
12

13 Construction of a new transmission line has not been assessed for the Gillespie SEZ,
14 assuming connection to the existing 500-kV line would be possible; impacts on air quality would
15 be evaluated at the project-specific level if new transmission construction or line upgrades would
16 occur. In addition, some construction of transmission lines could occur within the SEZ and over
17 a short distance (0.6 mi [1.0 km]) to the regional grid. Potential impacts on ambient air quality
18 would be a minor component of construction impacts in comparison with solar facility
19 construction and would be temporary.
20

21 **8.3.13.2.2 Operations**

22 Emission sources associated with the operation of a solar facility would include auxiliary
23 boilers; vehicle (commuter, visitor, support, and delivery) traffic; maintenance (e.g., mirror
24 cleaning and repair and replacement of damaged mirrors); and drift from cooling towers for the
25 parabolic trough or power tower technology if wet cooling were implemented (drift comprises
26 low-level PM emissions). Some of these sources may need to comply with emissions standards
27 including, but not limited to, the New Source Performance Standards (NSPS) for boilers
28 (40 CFR 60), the NSPS for stationary diesels (40 CFR 60 Subpart III), federal requirements for
29 nonroad diesels (40 CFR 89), and the NESHAP for stationary reciprocating engines (40 CFR 63
30 Subpart ZZZZ). In addition, given the typically small emissions, it is unlikely that PSD
31 requirements would apply to typical solar energy facilities.
32
33
34

35 Potential air emissions displaced by solar project development at the Gillespie SEZ are
36 presented in Table 8.3.13.2-2. Total power generation capacity ranging from 233 to 419 MW is
37 estimated for the Gillespie SEZ for various solar technologies (see Section 8.3.2). The estimated
38 amount of emissions avoided for the solar technologies evaluated depends only on the megawatts
39 of conventional fossil fuel-generated power displaced, because a composite emission factor per
40 megawatt-hour of power by conventional technologies is assumed (EPA 2009d). If the Gillespie
41 SEZ were fully developed, it is expected that emissions avoided would be fairly modest.
42 Development of solar power in the SEZ would result in avoided air emissions ranging from
43 0.59 to 1.1% of total emissions of SO₂, NO_x, Hg, and CO₂ from electric power systems in the
44 state of Arizona (EPA 2009d). Avoided emissions would be up to 0.27% of total emissions from
45 electric power systems in the six-state study area. When compared with all source categories,
46 power production from the same solar facilities would displace up to 0.51% of SO₂, 0.24% of

TABLE 8.3.13.2-2 Annual Emissions from Combustion-Related Power Generation Avoided by Full Solar Development of the Proposed Gillespie SEZ

Area Size (acres)	Capacity (MW) ^a	Power Generation (GWh/yr) ^b	Emissions Displaced (tons/yr; 10 ³ tons/yr for CO ₂) ^c			
			SO ₂	NO _x	Hg	CO ₂
2,618	233–419	408–734	314–565	483–870	0.004–0.008	347–624
Percentage of total emissions from electric power systems in Arizona ^d			0.59–1.1%	0.59–1.1%	0.59–1.1%	0.59–1.1%
Percentage of total emissions from all source categories in Arizona ^e			0.28–0.51%	0.13–0.24%	– ^f	0.32–0.58%
Percentage of total emissions from electric power systems in the six-state study area ^d			0.13–0.23%	0.13–0.24%	0.15–0.27%	0.13–0.24%
Percentage of total emissions from all source categories in the six-state study area ^e			0.07–0.12%	0.02–0.03%	–	0.04–0.07%

- ^a It is assumed that the SEZ would eventually have development on 80% of the lands and that a range of 5 acres (0.020 km²) per MW (for parabolic trough technology) to 9 acres (0.036 km²) per MW (power tower, dish engine, and PV technologies) would be required.
- ^b A capacity factor of 20% was assumed.
- ^c Composite combustion-related emission factors for SO₂, NO_x, Hg, and CO₂ of 1.54, 2.37, 2.2 × 10⁻⁵, and 1,700 lb/MWh, respectively, were used for the state of Arizona.
- ^d Emission data for all air pollutants are for 2005.
- ^e Emission data for SO₂ and NO_x are for 2002, while those for CO₂ are for 2005.
- ^f Not estimated.

Sources: EPA (2009b,d); WRAP (2009).

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NO_x, and 0.58% of CO₂ emissions in the state of Arizona (EPA 2009b; WRAP 2009). These emissions would be up to 0.12% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel-fired power plants accounts for about 68% of the total electric power generated in Arizona; contribution of coal combustion is about 40%, followed by natural gas combustion of about 28%, and nuclear generation of about 25%. Thus, solar facilities to be built in the Gillespie SEZ could reduce fuel combustion-related emissions in Arizona to some extent, but relatively less so than those built in other states with higher fossil fuel use rates.

As discussed in Section 5.11.1.5, the operation of associated transmission lines would generate some air pollutants from activities such as periodic site inspections and maintenance. However, these activities would occur infrequently, and the amount of emissions would be small. In addition, transmission lines could produce minute amounts of O₃ and its precursor,

1 NO_x, associated with corona discharge (i.e., the breakdown of air near high-voltage conductors),
2 which is most noticeable for high-voltage lines during rain or very humid conditions. Since
3 the Gillespie SEZ is located in an arid desert environment, these emissions would be small, and
4 potential impacts on ambient air quality associated with transmission lines would be negligible,
5 based on the infrequent occurrences and small amount of emissions from corona discharges.
6
7

8 **8.3.13.2.3 Decommissioning/Reclamation**

9

10 As discussed in Section 5.11.1.4, decommissioning/reclamation activities are similar to
11 construction activities but are on a more limited scale and of shorter duration. Potential impacts
12 on ambient air quality would be correspondingly less than those from construction activities.
13 Decommissioning activities would last for a short period, and their potential impacts would be
14 moderate and temporary. The same mitigation measures adopted during the construction phase
15 would also be implemented during the decommissioning phase (Section 5.11.3).
16
17

18 **8.3.13.3 SEZ-Specific Design Features and Design Feature Effectiveness**

19

20 No SEZ-specific design features are required. Limiting dust generation during
21 construction and operations at the proposed Gillespie SEZ (through such measures as increased
22 watering frequency or road paving or treatment) is a required design feature under BLM's Solar
23 Energy Program. These extensive fugitive dust control measures would keep off-site PM levels
24 as low as possible during construction.
25

1 **8.3.14 Visual Resources**

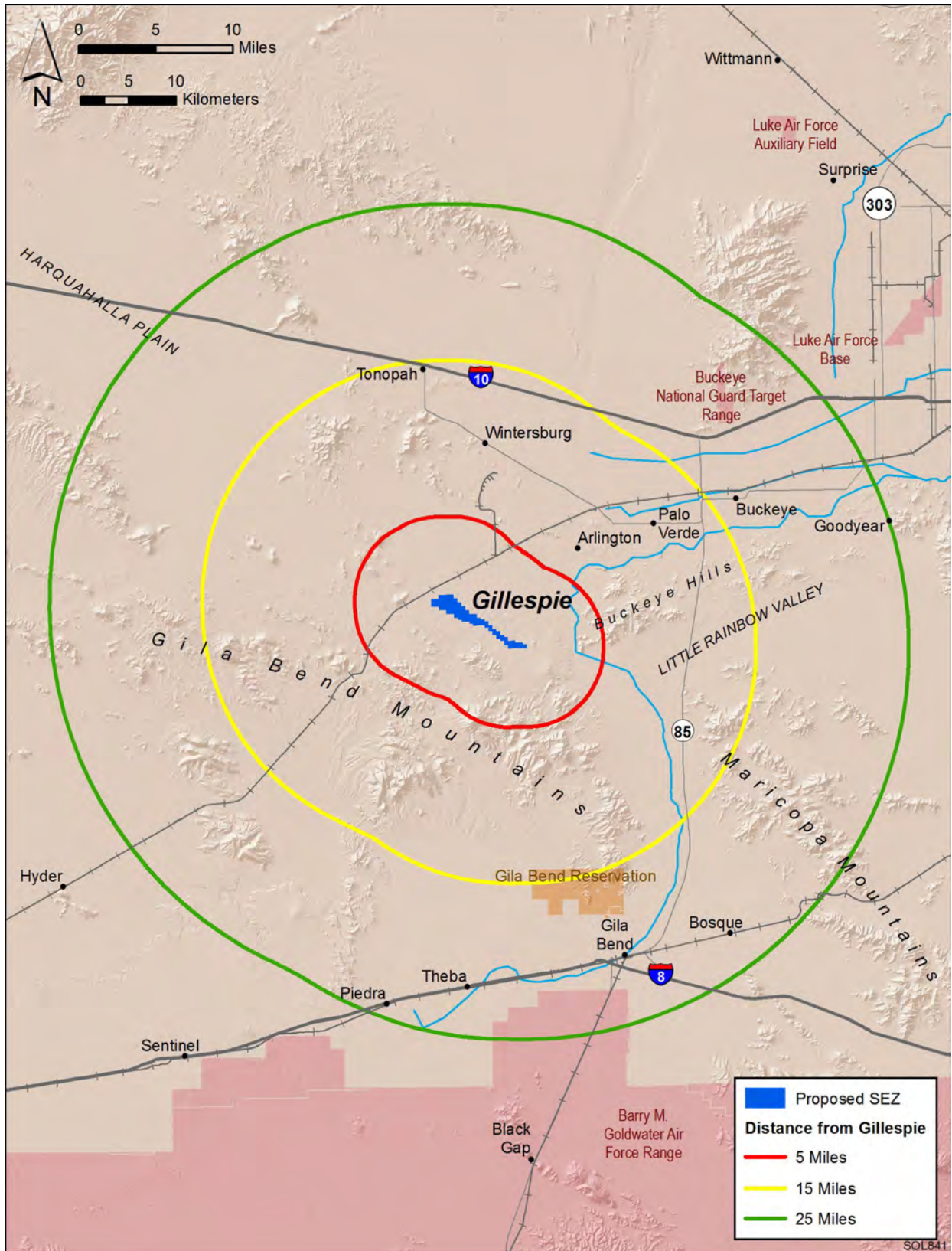
2
3
4 **8.3.14.1 Affected Environment**

5
6 The proposed Gillespie SEZ is located in Maricopa County in southwestern Arizona. The
7 SEZ occupies 2,618 acres (10.6 km²) and extends approximately 6.9 mi (11.1 km) in a northwest
8 to southeast direction and is approximately 2 mi (3.2 km) wide. The SEZ is within the Sonoran
9 basin and range physiographic province, typified by scattered low mountains and containing
10 large tracts of federally owned land, most of which are used for military training. The Sonoran
11 basin and range is slightly hotter than the Mojave basin and range and has large areas of
12 paloverde-cactus shrub and giant saguaro cactus (EPA 2002, 2007). The SEZ slopes gently
13 toward the southeast, with elevations ranging from 984 ft (300 m) in the northwestern portion to
14 885 ft (270 m) in the southeastern portion.

15
16 The SEZ lies in an area of undulating topography, however, it is relatively flat. Woolsey
17 Peak dominates views to the south of the SEZ, and Webb Mountain, Signal Mountains, Black
18 Butte, and Yellow Medicine Hills are prominently visible to the south, southwest, and western
19 sides of the SEZ, respectively. These nearby mountains add significantly to the scenic value of
20 the SEZ. Mountains to the north and east are too far away to have a significant effect on scenic
21 values. The blocky form of Woolsey Peak, located about 4 mi (6.4 km) south of the SEZ
22 (elevation of 3,270 ft [997 m]), is particularly prominent from the western portion of the SEZ,
23 and is a geographical landmark visible from much of southwestern Arizona. The mountains to
24 the southwest and west of the SEZ range in elevation from 1,200 ft (365.8 m) to 1,570 ft
25 (478.5 m). Webb Mountain dominates views from much of the SEZ, and the juxtaposition of its
26 pointed peak with the blocky summit of Woolsey Peak is striking from some viewpoints within
27 the SEZ. The mountain slopes and peaks surrounding the SEZ generally are visually pristine

28
29 The SEZ is located within a relatively flat, desert floor, with the strong horizon line and
30 surrounding mountain ranges being the dominant visual features. Several intermittent washes run
31 through the SEZ in a southwest to northeast direction. The surrounding mountains are generally
32 red to brown in color, with distant mountains appearing blue to purple. In contrast, pink to tan
33 gravels dominate the desert floor, which is sparsely dotted with the greens of vegetation. The
34 SEZ also contains areas with dark volcanic rock. Washes contain light-colored tan soils mixed
35 with gray gravel, rocks, and boulders. No permanent surface water is present within the SEZ.
36 The location of the SEZ and surrounding mountain ranges are shown in Figure 8.3.14.1-1.

37
38 Vegetation is generally sparse in much of the SEZ, with widely spaced shrubs growing
39 on more or less barren gravel flats. Vegetation within the SEZ is predominantly scrubland, with
40 creosotebush and other low shrubs dominating the desert floor within the SEZ. During a
41 September 2009 site visit, the vegetation presented a range of greens (mostly the olive green of
42 creosotebushes) with some grays and tans (from lower shrubs), with medium to coarse textures.
43 The desert floor is sparsely dotted with the olive green of creosotebush and the light greens of
44 saguaros, paloverde, and other trees. Saguaros and denser, deeper green vegetation along some
45 washes add some visual interest; however, visual interest is generally low.



1

2 **FIGURE 8.3.14.1-1 Proposed Gillespie SEZ and Surrounding Lands**

1 Cultural disturbances visible within the SEZ include a graded, county gravel road and
2 other unpaved roads, and fencing. Outside the SEZ, visible cultural modifications include the
3 Palo Verde nuclear power plant (prominently visible from the SEZ), three natural gas power
4 plants, a railroad, transmission lines, and a pipeline ROW. These cultural modifications generally
5 detract from the scenic quality of the SEZ.
6

7 The general lack of topographic relief, water, and physical variety results in low scenic
8 value within the SEZ itself; however, because of the flatness of the landscape, the lack of trees,
9 and the breadth of the open desert, the SEZ presents a vast panoramic landscape with sweeping
10 views of the surrounding mountains that add significantly to the scenic values within the SEZ
11 viewshed. In general, the mountains appear to be devoid of vegetation, and their varied and
12 irregular forms, and red to brown colors, provide visual contrasts to the strong horizontal line,
13 green vegetation, and pink to tan gravels of the valley floor, particularly when viewed from
14 nearby locations within the SEZ. Panoramic views of the SEZ are shown in Figures 8.3.14.1-2,
15 8.3.14.1-3, and 8.3.14.1-4.
16

17 The BLM conducted a VRI for the SEZ and surrounding lands in 2010 (BLM 2010a).
18 The VRI evaluates BLM-administered lands based on scenic quality; sensitivity level, in terms of
19 public concern for preservation of scenic values in the evaluated lands; and distance from travel
20 routes or KOPs. Based on these three factors, BLM-administered lands are placed into one of
21 four VRI Classes, which represent the relative value of the visual resources. Class I and II are
22 the most valued; Class III represents a moderate value; and Class IV represents the least value.
23 Class I is reserved for specially designated areas, such as national wildernesses and other
24 congressionally and administratively designated areas where decisions have been made to
25 preserve a natural landscape. Class II is the highest rating for lands without special designation.
26 More information about VRI methodology is available in Section 5.12 and in *Visual Resource*
27 *Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).
28

29 The VRI values for the SEZ and immediate surroundings are VRI Class III, indicating
30 moderate visual values. The inventory indicates low scenic quality for the SEZ and its immediate
31 surroundings. Positive scenic quality attributes included adjacent scenery. The inventory
32 indicates high sensitivity for the SEZ and its immediate surroundings, primarily because of its
33 immediate proximity to Agua Caliente Road, a BLM-proposed backcountry byway, and a scenic,
34 high-use travel corridor with a high degree of public interest.
35

36 Lands in the Lower Sonoran FO within the 25-mi (40-km), 650-ft (198-m) viewshed of
37 the SEZ include 23,785 acres (96.255 km²) of VRI Class I areas, primarily Woolsey Peak and
38 Signal Mountain WA's south and southeast of the SEZ; 16,835 acres (68.129 km²) of VRI Class
39 II areas, primarily west of the SEZ; 115,948 acres (469.225 km²) of Class III areas, primarily
40 surrounding the SEZ; and 226,461 acres (916.455 km²) of VRI Class IV areas, concentrated
41 primarily north, south, and east of the SEZ.
42

43 The VRI map for the SEZ and surrounding lands is shown in Figure 8.3.14.1-5. More
44 information about VRI methodology is available in Section 5.12 and in *Visual Resource*
45 *Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).
46

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FIGURE 8.3.14.1-2 Approximately 120° Panoramic View of the Proposed Gillespie SEZ from Central Portion of the SEZ Facing Southwest, with Webb Mountain in Foreground and Woolsey Peak in Background

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4

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6



7

FIGURE 8.3.14.1-3 Approximately 180° Panoramic View of the Proposed Gillespie SEZ from Western Portion of SEZ Facing Southwest, Webb Mountain and Woolsey Peak at Left, Black Butte and Yellow Medicine Hills at Right

8

9

10

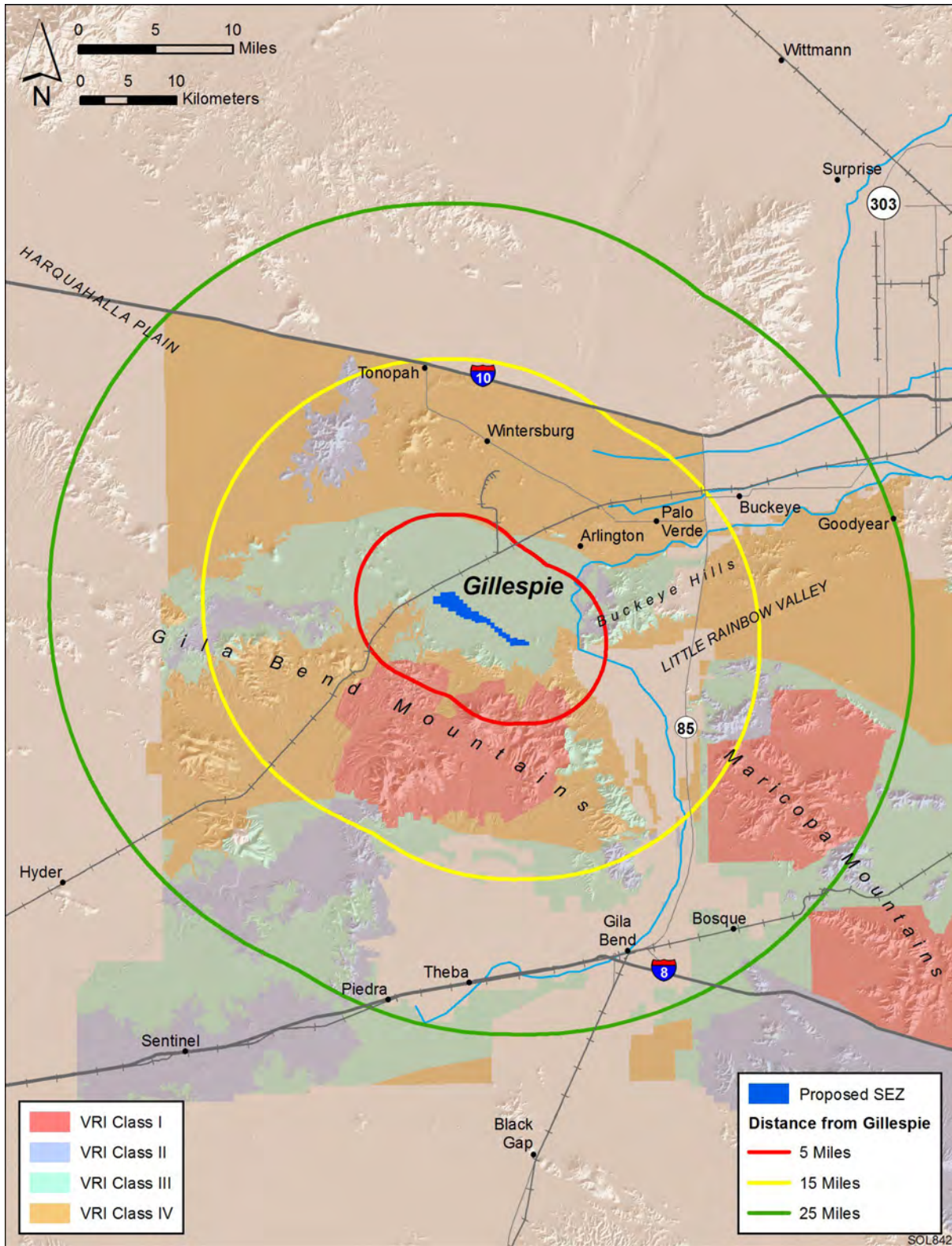
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12

FIGURE 8.3.14.1-4 Approximately 120° Panoramic View of the Proposed Gillespie SEZ from Central Portion of SEZ Facing Northwest, with Black Butte at Far Left, Yellow Medicine Hills at Left Center, Saddle Mountain at Center, and Palo Verde Hills at Right Center

13



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4

FIGURE 8.3.14.1-5 Visual Resource Inventory Values for the Proposed Gillespie SEZ and Surrounding Lands

1 The *Approved Amendment to the Lower Gila North Management Framework Plan and*
2 *the Lower Gila South Resource Management Plan and Decision Record* (BLM 2005) indicate
3 that the SEZ is managed as VRM Class IV. VRM Class IV permits major modification of the
4 existing character of the landscape. More information about the BLM VRM program is available
5 in Section 5.12 and in *Visual Resource Management*, BLM Manual Handbook 8400
6 (BLM 1984).

9 **8.3.14.2 Impacts**

11 The potential for impacts from utility-scale solar energy development on visual resources
12 within the proposed Gillespie SEZ and surrounding lands, as well as the impacts of related
13 developments (e.g., access roads and transmission lines) outside of the SEZ, is presented in this
14 section.

16 Site-specific impact assessment is needed to systematically and thoroughly assess visual
17 impact levels for a particular project. Without precise information about the location of a project,
18 a relatively complete and accurate description of its major components, and their layout, it is not
19 possible to assess precisely the visual impacts associated with the facility. However, if the
20 general nature and location of a facility are known, a more generalized assessment of potential
21 visual impacts can be made by describing the range of expected visual changes and discussing
22 contrasts typically associated with these changes. In addition, a general analysis can identify
23 sensitive resources that may be at risk if a future project is sited in a particular area. Detailed
24 information about the methodology employed for the visual impact assessment used in this
25 PEIS, including assumptions and limitations, is presented in Appendix M.

27 *Potential Glint and Glare Impacts.* Similarly, the nature and magnitude of potential glint-
28 and glare-related visual impacts for a given solar facility is highly dependent on viewer position,
29 sun angle, the nature of the reflective surface and its orientation relative to the sun and the
30 viewer, atmospheric conditions, and other variables. The determination of potential impacts from
31 glint and glare from solar facilities within a given proposed SEZ would require precise
32 knowledge of these variables, and is not possible given the scope of the PEIS. Therefore, the
33 following analysis does not describe or suggest potential contrast levels arising from glint and
34 glare for facilities that might be developed within the SEZ; however, it should be assumed that
35 glint and glare are possible visual impacts from *any* utility-scale solar facility, regardless of size,
36 landscape setting, or technology type. The occurrence of glint and glare at solar facilities could
37 potentially cause large, but temporary, increases in brightness and visibility of the facilities. The
38 visual contrast levels projected for sensitive visual resource areas discussed in the following
39 analysis do not account for potential glint and glare effects; however, these effects would be
40 incorporated into a future site- and project-specific assessment that would be conducted for
41 specific proposed utility-scale solar energy projects. For more information about potential glint
42 and glare impacts associated with utility-scale solar energy facilities, see Section 5.12.

1 **8.3.14.2.1 Impacts on the Proposed Gillespie SEZ**
2

3 Some or all of the SEZ could be developed for one or more utility-scale solar energy
4 projects, utilizing one or more of the solar energy technologies described in Appendix F.
5 Because of the industrial nature and large size of utility-scale solar energy facilities, large visual
6 impacts on the SEZ would occur as a result of the construction, operation, and decommissioning
7 of solar energy projects. In addition, large impacts could occur at solar facilities utilizing highly
8 reflective surfaces or major light-emitting components (solar dish, parabolic trough, and power
9 tower technologies), with lesser impacts associated with reflective surfaces expected from PV
10 facilities. These impacts would be expected to involve major modification of the existing
11 character of the landscape and would likely dominate the views nearby. Additional, and
12 potentially large impacts would occur as a result of the construction, operation, and
13 decommissioning of related facilities, such as access roads and electric transmission lines. While
14 the primary visual impacts associated with solar energy development within the SEZ would
15 occur during daylight hours, lighting required for utility-scale solar energy facilities would be a
16 potential source of visual impacts at night, both within the SEZ and on surrounding lands.
17

18 Common and technology-specific visual impacts from utility-scale solar energy
19 development, as well as impacts associated with electric transmission lines, are discussed in
20 Section 5.12 of this PEIS. Impacts would last throughout construction, operation, and
21 decommissioning, and some impacts could continue after project decommissioning. Visual
22 impacts resulting from solar energy development in the SEZ would be in addition to impacts
23 from solar energy development and other development that may occur on other public or private
24 lands within the SEZ viewshed, and are subject to cumulative effects. For discussion of
25 cumulative impacts, see Section 8.3.22.4.13.
26

27 The changes described above would be expected to be consistent with BLM VRM
28 objectives for VRM Class IV, as seen from nearby KOPs. VRM Class IV is the current VRM
29 Class designation for the proposed Gillespie SEZ. More information about impact determination
30 using the BLM VRM program is available in Section 5.12 and in *Visual Resource Contrast*
31 *Rating*, BLM Manual Handbook 8431-1 (BLM 1986b).
32

33 Implementation of the programmatic design features intended to reduce visual impacts
34 (described in Appendix A, Section A.2.2) would be expected to reduce visual impacts associated
35 with utility-scale solar energy development within the SEZ; however, the degree of effectiveness
36 of these design features could be assessed only at the site- and project-specific level. Given the
37 large scale, reflective surfaces, and strong regular geometry of utility-scale solar energy facilities
38 and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities
39 away from sensitive visual resource areas and other sensitive viewing areas would be the primary
40 means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures
41 would generally be limited, but would be important to reduce visual contrasts to the greatest
42 extent possible.
43
44
45

1 **8.3.14.2.2 Impacts on Lands Surrounding the Proposed Gillespie SEZ**
2

3 Because of the large size of utility-scale solar energy facilities and the generally flat,
4 open nature of the proposed SEZ, lands outside the SEZ would be subjected to visual impacts
5 related to construction, operation, and decommissioning of utility-scale solar energy facilities.
6 The affected areas and extent of impacts would depend on a number of visibility factors and
7 viewer distance (for a detailed discussion of visibility and related factors, see Section 5.12).
8 A key component in determining impact levels is the intervisibility between the project and
9 potentially affected lands; if topography, vegetation, or structures screen the project from
10 viewer locations, there is no impact.
11

12 Preliminary viewshed analyses were conducted to identify which lands surrounding
13 the proposed SEZ would have views of solar facilities in at least some portion of the SEZ
14 (see Appendix M for information on the assumptions and limitations of the methods used).
15 Four viewshed analyses were conducted, assuming four different heights representative of
16 project elements associated with potential solar energy technologies: PV and parabolic trough
17 arrays (24.6 ft [7.5 m]), solar dishes and power blocks for CSP technologies (38 ft [11.6 m]),
18 transmission towers and short solar power towers (150 ft [45.7 m]), and tall solar power towers
19 (650 ft [198.1 m]). Viewshed maps for the SEZ for all four solar technology heights are
20 presented in Appendix N.
21

22 Figure 8.3.14.2-1 shows the combined results of the viewshed analyses for all four solar
23 technologies. The colored segments indicate areas with clear lines of sight to one or more areas
24 within the SEZ and from which solar facilities within these areas of the SEZ would be expected
25 to be visible, assuming the absence of screening vegetation or structures and adequate lighting
26 and other atmospheric conditions. The light brown areas are locations from which PV and
27 parabolic trough arrays located in the SEZ could be visible. Solar dishes and power blocks for
28 CSP technologies would be visible from the areas shaded in light brown and the additional areas
29 shaded in light purple. Transmission towers and short solar power towers would be visible from
30 the areas shaded light brown, light purple, and the additional areas shaded in dark purple. Power
31 tower facilities located in the SEZ could be visible from areas shaded light brown, light purple,
32 dark purple, and at least the upper portions of power tower receivers would be visible from the
33 additional areas shaded in medium brown.
34

35 For the following visual impact discussion, the tall solar power tower (650 ft [198.1 m])
36 and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds are shown in the figures and
37 discussed in the text. These heights represent the maximum and minimum landscape visibility
38 for solar energy technologies analyzed in this PEIS. Viewsheds for solar dish and CSP
39 technology power blocks (38 ft [11.6 m]), and for transmission towers and short solar power
40 towers (150 ft [45.7 m]) are described in Appendix N. The visibility of these facilities would fall
41 between that for tall power towers and PV and parabolic trough arrays.
42

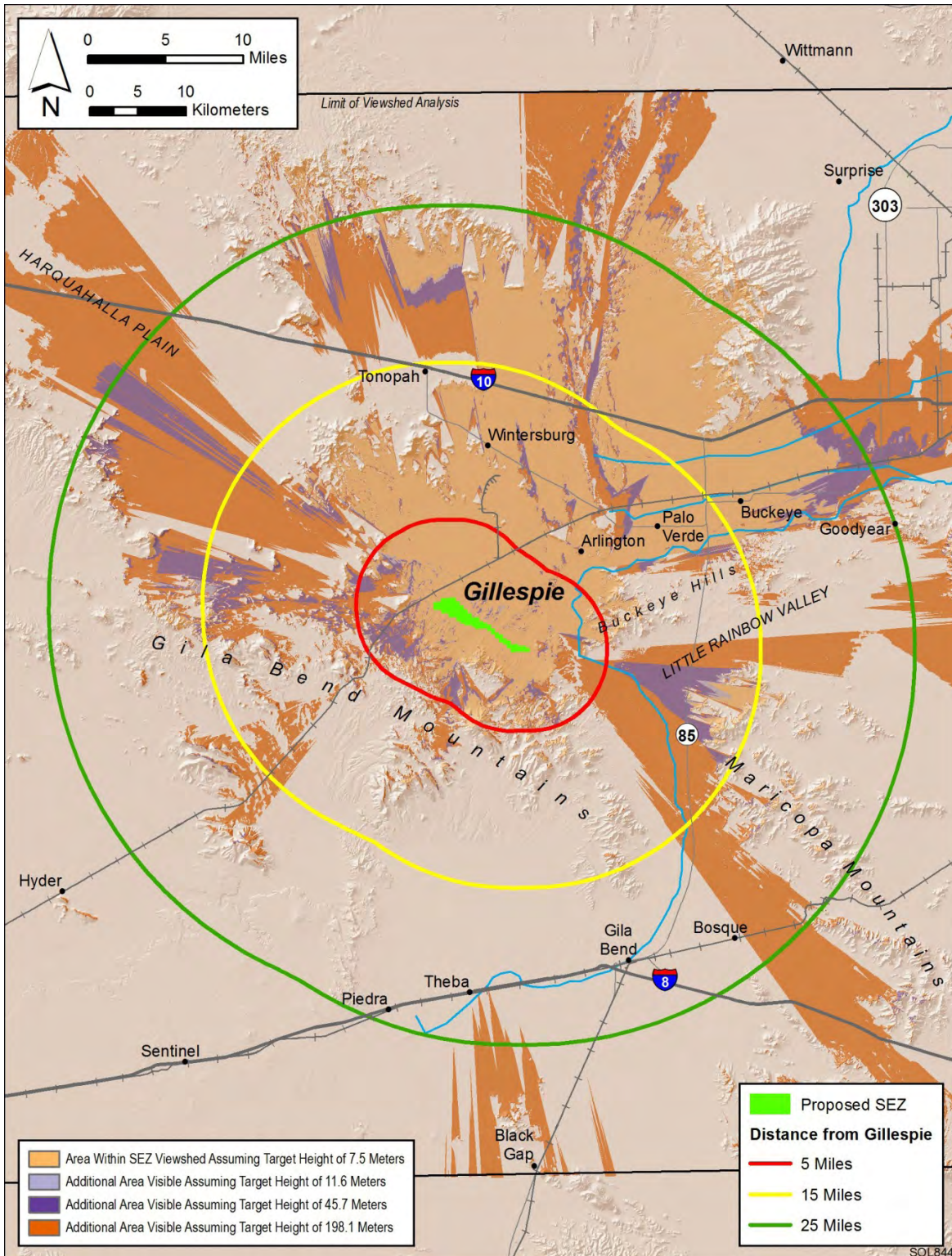


FIGURE 8.3.14.2-1 Viewshed Analyses for the Proposed Gillespie SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

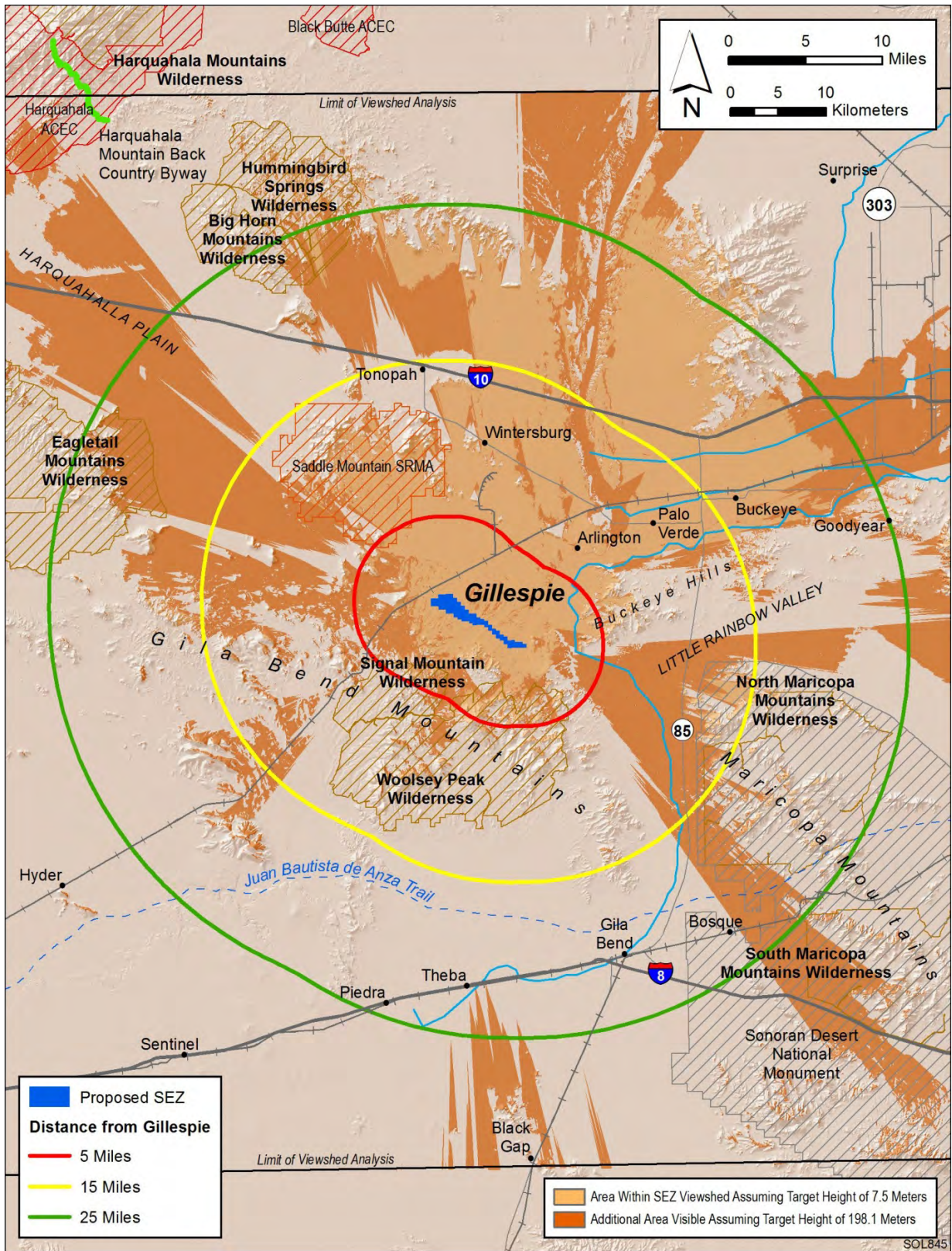
1 **Impacts on Selected Federal-, State-, and BLM-Designated Sensitive Visual**
2 **Resource Areas**

3
4 Figure 8.3.14.2-2 shows the results of a GIS analysis that overlays selected federal, state,
5 and BLM-designated sensitive visual resource areas onto the combined tall solar power tower
6 (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds in order to
7 illustrate which of these sensitive visual resource areas would have views of solar facilities
8 within the SEZ and therefore potentially would be subject to visual impacts from those facilities.
9 Distance zones that correspond with BLM’s VRM system-specified foreground-middleground
10 distance (5 mi [8 km]), background distance (15 mi [24 km]), and a 25-mi (40-km) distance zone
11 are shown as well, in order to indicate the effect of distance from the SEZ on impact levels,
12 which are highly dependent on distance.

13
14 The scenic resources included in the analyses were as follows:

- 15 • National Parks, National Monuments, National Recreation Areas, National
16 Preserves, National Wildlife Refuges, National Reserves, National
17 Conservation Areas, National Historic Sites;
- 18 • Congressionally authorized Wilderness Areas;
- 19 • Wilderness Study Areas;
- 20 • National Wild and Scenic Rivers;
- 21 • Congressionally authorized Wild and Scenic Study Rivers;
- 22 • National Scenic Trails and National Historic Trails;
- 23 • National Historic Landmarks and National Natural Landmarks;
- 24 • All-American Roads, National Scenic Byways, State Scenic Highways, and
25 BLM- and USFS-designated scenic highways/byways;
- 26 • BLM-designated Special Recreation Management Areas; and
- 27 • ACECs designated because of outstanding scenic qualities.

28
29
30
31
32 Potential impacts on specific sensitive resource areas visible from and within 25 mi
33 (40 km) of the proposed Gillespie SEZ are discussed below. The results of this analysis are also
34 summarized in Table 8.3.14.2-1. Further discussion of impacts on these areas is available in
35 Sections 8.3.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and
36 Section 8.3.17 (Cultural Resources).
37
38



1

2 **FIGURE 8.3.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft**
 3 **(198.1-m) and 24.6-ft (7.5-m) Viewsheds for the Proposed Gillespie SEZ**

TABLE 8.3.14.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40-km) Viewshed of the Proposed Gillespie SEZ, Assuming a Target Height of 650 ft (198.1 m)

Feature Type	Feature Name (Total Acreage/Highway Length) ^a	Feature Area or Linear Distance ^b		
		Visible within 5 mi	Visible between	
			5 and 15 mi	15 and 25 mi
National Monument	Sonoran Desert National Monument (496,513 acres)	0 acres	8,356 acres (2%)	18,931 acres (4%)
National Historic Trail	Juan Bautista de Anza (1,210 mi)	0 mi	0 mi	4.7 mi
WAs	Big Horn Mountains (20,954 acres)	0 acres	0 acres	2,303 acres (11%)
	Eagletail Mountains (98,544 acres)	0 acres	0 acres	11,918 acres (12%)
	Hummingbird Springs (31,429 acres)	0 acres	0 acres	4,501 acres (14%)
	North Maricopa Mountains (64,247 acres)	0 acres	1,331 acres (2%)	8,540 acres (13%)
	Signal Mountain (13,467 acres)	1,920 acres (14%)	594 acres (4%)	0 acres
	South Maricopa Mountains (60,446 acres)	0 acres	0 acres	3 acres (0.01%)
	Woolsey Peak (64,465 acres)	5,552 acres (9%)	5,837 acres (9%)	0 acres
SRMA	Saddle Mountain (47,696 acres)	661 acres (1%)	26,562 acres (56%)	14 acres (0.03%)

^a To convert acres to km², multiply by 0.004047. To convert mi to km, multiply by 1.609.

^b Percentage of total feature or road length viewable.

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The following visual impact analysis describes *visual contrast levels* rather than *visual impact levels*. *Visual contrasts* are changes in the landscape as seen by viewers, including changes in the forms, lines, colors, and textures of objects seen in the landscape. A measure of *visual impact* includes potential human reactions to the visual contrasts arising from a development activity, based on viewer characteristics, including attitudes and values, expectations, and other characteristics that are viewer- and situation-specific. Accurate assessment of visual impacts requires knowledge of the potential types and numbers of viewers

1 for a given development and their characteristics and expectations, specific locations from which
2 the project might be viewed, and other variables that were not available or not feasible to
3 incorporate in the PEIS analysis. These variables would be incorporated into a future site- and
4 project-specific assessment that would be conducted for specific proposed utility-scale solar
5 energy projects. For more discussion of visual contrasts and impacts, see Section 5.12.
6
7

8 *National Monument*

9

- 10 • *Sonoran Desert National Monument*—Sonoran Desert National Monument
11 contains 496,513 acres (2,009.32 km²) and is located about 12 mi (19 km)
12 southeast of the SEZ at the point of closest approach. The monument contains
13 three distinct mountain ranges, the Maricopa, Sand Tank and Table Top
14 Mountains, as well as the Booth and White Hills, all separated by wide
15 valleys. The monument contains three congressionally designated WAs, many
16 significant archaeological and historic sites, and remnants of several important
17 historic trails.
18

19 As shown in Figure 8.3.14.2-2, within the National Monument, visibility of
20 solar facilities within the SEZ would be limited to two general areas: the
21 peaks and northwestern slopes of the Maricopa Mountains and portions of the
22 Gila River valley between the Gila Bend Mountains and the Maricopa
23 Mountains. The area within the National Monument with views of the SEZ
24 includes about 27,287 acres (110.43 km²) in the 650-ft (198.1-m) viewshed,
25 or 6% of the total National Monument acreage, and 5,424 acres (21.95 km²)
26 in the 24.6-ft (7.5-m) viewshed, or 1% of the total National Monument
27
28

GOOGLE EARTH™ VISUALIZATIONS

The visual impact analysis discussion in this section utilizes three-dimensional Google Earth™ perspective visualizations of hypothetical solar facilities placed within the SEZ. The visualizations include simplified wireframe models of a hypothetical solar power tower facility. The models were placed at various locations within the SEZ as visual aids for assessing the approximate size and viewing angle of utility-scale solar facilities. The visualizations are intended to show the apparent size, distance, and configuration of the SEZ, as well as the apparent size of a typical utility-scale solar power tower project and its relationship to the surrounding landscape, as viewed from potentially sensitive visual resource areas within the viewshed of the SEZ.

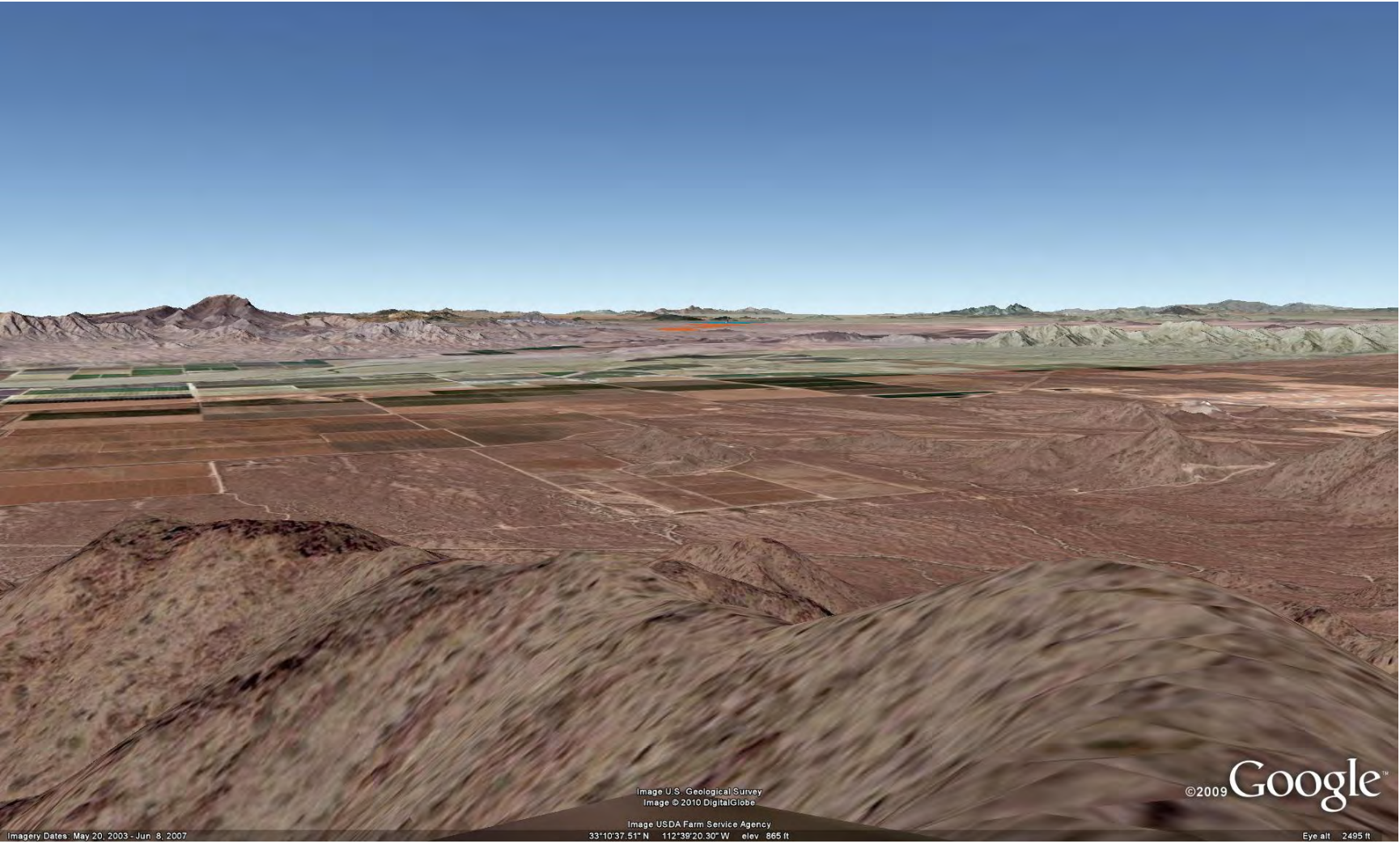
The visualizations are not intended to be realistic simulations of the actual appearance of the landscape or of proposed utility-scale solar energy projects. The placement of models within the SEZ did not reflect any actual planned or proposed projects within the SEZ, and did not take into account engineering or other constraints that would affect the siting or choice of facilities for this particular SEZ. The number of facility models placed in the SEZ does not reflect the 80% development scenario analyzed in this PEIS, but it should be noted that the discussion of expected visual contrast levels does account for the 80% development scenario. A solar power tower was chosen for the models because the unique height characteristics of power tower facilities make their visual impact potential extend beyond other solar technology types.

1 acreage. The visible area of the National Monument extends to beyond 25 mi
2 (40 km) from the southeastern boundary of the SEZ.
3

4 On the Gila River valley floor, visibility of solar facilities within the SEZ
5 would be limited to taller facility components, with visibility for most of the
6 valley floor limited to the upper portions of taller power towers. Views of the
7 SEZ from the valley floor are through a roughly 3-mi (5-km) gap between the
8 Gila Bend Mountains and the Buckeye Hills. Low hills within the gap would
9 screen views of lower height solar facilities within the SEZ because the valley
10 floor is at nearly the same elevation as the SEZ. The SEZ would be viewed
11 along its long and narrow southeast to northwest axis and would be far enough
12 away from the viewpoint that it would occupy a very small portion of the
13 horizontal field of view. For the portions of the valley floor within the
14 National Monument with maximum visibility of solar development within the
15 SEZ, transmission lines, as well as the upper portions of transmission towers
16 and power towers receivers (and the tower structures) could be visible just
17 above the horizon within the gap between the Gila Bend Mountains and the
18 Buckeye Hills. At a distance of 11+ mi (18+ km), operating power tower
19 receivers within the SEZ would likely appear as points of light against a sky
20 backdrop. If more than 200 ft (61 m) tall, power towers would have
21 navigation warning lights that could potentially be visible from the National
22 Monument at night. Expected visual contrasts would be weak at locations with
23 maximum visibility and minimal at other locations within the National
24 Monument on the valley floor.
25

26 For peaks and northwest-facing ridges in the Maricopa Mountains, views of
27 the SEZ would also be through the gap between the Gila Bend Mountains and
28 the Buckeye Hills; however, the viewpoint elevations are generally high
29 enough that lower height facilities in one or more parts of the SEZ would be
30 visible.
31

32 Figure 8.3.14.2-3 is a Google Earth visualization of the SEZ as seen from
33 Margies Peak in the far northwestern portion of the National Monument,
34 about 14 mi (23 km) from the southeast corner of the SEZ, and within the
35 National Monument, near the point of maximum visibility of solar
36 development within the SEZ. The visualization includes a simplified
37 wireframe model of a hypothetical solar power tower facility. The model was
38 placed within the SEZ as a visual aid for assessing the approximate size and
39 viewing angle of utility-scale solar facilities. The receiver tower depicted in
40 the visualization is a properly scaled model of a 459-ft (140-m) power tower
41 with an 867-acre (3.5-km²) field of 12-ft (3.7-m) heliostats, and the
42 tower/heliostat system represents about 100 MW of electric generating
43 capacity. One model was placed in the western portion of the SEZ for this and
44 other visualizations shown in this section of this PEIS. In the visualization, the
45 SEZ area is depicted in orange, the heliostat fields in blue.
46



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FIGURE 8.3.14.2-3 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Margies Peak in the Sonoran Desert National Monument

1 The viewpoint in the visualization is about 1,550 ft (472 m) higher in
2 elevation than the SEZ. Despite the elevated viewpoint, because of the long
3 distance to the SEZ, collector/reflector arrays for solar facilities within the
4 SEZ would be seen nearly edge-on, and they would repeat the line of the
5 valley floor in which the SEZ is located, which would tend to reduce visual
6 contrast. The edge-on view would also tend to reduce their apparent size and
7 conceal their strong regular geometry, which would also reduce visual
8 contrast. The SEZ is viewed along its long and narrow southeast to northwest
9 axis, and is far enough away from the viewpoint that it would occupy a very
10 small portion of the horizontal field of view.

11
12 Operating power tower receivers within the SEZ would likely appear as points
13 of light against the floor of the valley in which the SEZ is located, or against
14 the base of the Yellow Medicine Hills. If more than 200 ft (61 m) tall, power
15 towers would have navigation warning lights that could potentially be visible
16 from the WA at night.

17
18 Visual contrasts associated with solar facilities within the SEZ would depend
19 on the numbers, types, sizes and locations of solar facilities in the SEZ, and
20 other visibility factors. Under the 80% development scenario analyzed in the
21 PEIS, weak visual contrasts from solar energy development within the SEZ
22 could be expected at this viewpoint.

23
24 In general, visual contrasts associated with solar facilities within the SEZ
25 would depend on viewer location within the National Monument, the
26 numbers, types, sizes and locations of solar facilities in the SEZ, and other
27 project- and site-specific factors. Under the 80% development scenario
28 analyzed in the PEIS, where there were unobstructed views, contrasts would
29 be expected to be minimal to weak.

30 31 32 *Wilderness Areas*

- 33
34 • *Big Horn Mountains*—Big Horn Mountains is a 20,954-acre (84.800-km²)
35 congressionally designated WA located 22 mi (35 km) northwest of the SEZ.
36 The WA is noted for its exceptional scenic values.

37
38 As shown in Figure 8.3.14.2-2, within 25 mi (40 km) of the SEZ, solar energy
39 facilities within the SEZ could be visible from the southeastern portions of the
40 WA (about 2,303 acres [9.320 km²] in the 650-ft [198.1-m] viewshed, or 11%
41 of the total WA acreage, and 86 acres [0.4 km²] in the 25-ft [7.5-m] viewshed,
42 or 0.4% of the total WA acreage). The visible area of the WA extends to
43 beyond 25 mi (40 km) from the southwestern boundary of the SEZ.

44
45 Viewpoints in the WA within the 25-mi (40 km) viewshed of the SEZ are
46 either on scattered peaks in the Bighorn Mountains, or at lower elevations

1 immediately southeast of the Bighorn Mountains in the Tonopah Desert.
2 Lower height solar facilities within the SEZ could be visible from some of the
3 higher elevation viewpoints in the WA. For viewpoints in the Tonopah Desert
4 within the WA, visibility would be restricted to taller solar facilities, including
5 transmission towers and lower power towers in a few areas, but only the upper
6 portions of tall power towers in most of Tonopah Desert viewpoints within the
7 WA. Where operating power towers were visible within the SEZ, they would
8 likely appear as distant star-like points of light against a backdrop of the Gila
9 Bend Mountains. If more than 200 ft (61 m) tall, power towers would have
10 navigation warning lights that could potentially be visible from the WA at
11 night.

12
13 Burnt Mountain, Saddle Mountain, and the Palo Verde Hills provide
14 substantial partial screening of the SEZ for nearly all WA viewpoints within
15 the 25-mi (40 km) SEZ viewshed, although there are viewpoints outside the
16 25-mi (40 km) viewshed high enough to have nearly unobstructed views of
17 the SEZ. Views toward the SEZ would be oblique to the long and narrow
18 northwest–southeast axis of the SEZ, so that the SEZ would occupy a
19 relatively narrow portion of the horizontal field of view. Due to the partial
20 screening and the relatively long distance to the SEZ (22+ mi [35+ km]),
21 expected visual contrast levels associated with solar energy development
22 within the SEZ would be minimal to weak for WA viewpoints within the 25-
23 mi (40-km) SEZ viewshed. The highest contrast levels would be expected for
24 the peaks in the Bighorn Mountains, with lower contrasts expected for lower
25 elevation viewpoints in the Tonopah Desert.

- 26
- 27 • *Eagletail Mountains*—Eagletail Mountains is a 98,544-acre (398.79-km²)
28 congressionally designated WA located 18 mi (29 km) at the point of closest
29 approach northwest of the SEZ. Recreation such as extended horseback riding
30 and backpacking trips, sightseeing, photography, rock climbing and day
31 hiking are enhanced by the topographic diversity, scenic character, size, as
32 well as the botanical, wildlife, and cultural values of the area.

33
34 As shown in Figure 8.3.14.2-2, within 25 mi (40 km), solar energy facilities
35 within the SEZ could be visible from portions of the eastern slopes of the
36 mountains within the WA. Visible areas of the WA within the 25-mi (40-km)
37 radius of analysis total about 11,918 acres (48.230 km²) in the 650-ft
38 (198.1-m) viewshed, or 13% of the total WA acreage, and 422 acres
39 (1.71 km²) in the 24.6-ft (7.5-m) viewshed, or 0.4% of the total WA acreage.
40 The visible area of the WA extends to beyond 25 mi (40 km) from the western
41 boundary of the SEZ.

42
43 For nearly all of the portions of the WA within the 25-mi (40 km) viewshed of
44 the SEZ, visibility of solar facilities within the SEZ would be limited to taller
45 facility components, such as transmission towers and power towers. Visibility
46 of lower-height solar facilities, such as solar dishes, parabolic trough and PV

1 arrays, would be limited to very small areas along the crest of the Eagletail
2 Mountains, including Eagletail Peak.

3
4 Figure 8.3.14.2-4 is a Google Earth visualization of the SEZ as seen from an
5 Eagletail Peak in the WA, about 23 mi (37 km) from the northwest corner of
6 the SEZ, and at the point of maximum visibility of solar development within
7 the SEZ. The viewpoint is elevated approximately 2,350 ft (716 m) above the
8 SEZ.

9
10 The visualization suggests that from this viewpoint, portions of the SEZ
11 would be screened from view by the Yellow Medicine Hills and other hills
12 close to the SEZ. The SEZ would occupy a very small portion of the
13 horizontal field of view. Despite the elevated viewpoint, because of the very
14 long distance to the SEZ, collector/reflector arrays within the SEZ would be
15 viewed nearly edge-on, which would reduce their apparent size and conceal
16 their strong regular geometry, and they would appear to repeat the horizon
17 line, which would lessen their visual contrast. If operating power towers were
18 visible within the SEZ, they would likely appear as distant star-like points of
19 light against the distant Maricopa Mountains during the day and, if more than
20 200 ft (61 m) tall, would have navigation warning lights at night that could be
21 visible from this location. Depending on solar facility location within the SEZ,
22 the types of solar facilities and their designs, and other visibility factors, weak
23 visual contrasts from solar energy development within the SEZ would be
24 expected at this location. Expected visual contrasts would be lower for almost
25 all other viewpoints within the WA, because while some viewpoints could be
26 as much as 5 mi (8 km) closer to the SEZ, their elevations would be much
27 lower, and substantially more of the SEZ (including any lower-height solar
28 facilities within the SEZ) would be screened from view. In addition, the
29 already low vertical angle of view would be even lower for viewpoints at
30 lower elevations, which would tend to reduce visual contrasts further.

- 31
32 • *Hummingbird Springs*—Hummingbird Springs is a 31,429-acre (127.19-km²)
33 congressionally designated WA located 22 mi (35 km) at the point of closest
34 approach northwest of the SEZ. The WA is noted for its exceptional scenic
35 values.

36
37 Visible areas of the WA within the 25-mi (40-km) radius of analysis total
38 about 4,501 acres (18.21 km²) in the 650-ft (198.1-m) viewshed, or 14%
39 of the total WA acreage, and 1,257 acres (5.087 km²) in the 24.6-ft (7.5-m)
40 viewshed, or 4% of the total WA acreage. The visible area of the WA extends
41 to beyond 25 mi (40 km) from the northwestern corner of the SEZ.

42
43 As shown in Figure 8.3.14.2-2, viewpoints in the WA within the 25-mi
44 (40-km) viewshed of the SEZ are at lower elevations near the northern edge of
45 the Tonopah Desert. Lower height solar facilities within the SEZ could be
46 visible from some of viewpoints in the 25-mi (40-km) viewshed within the

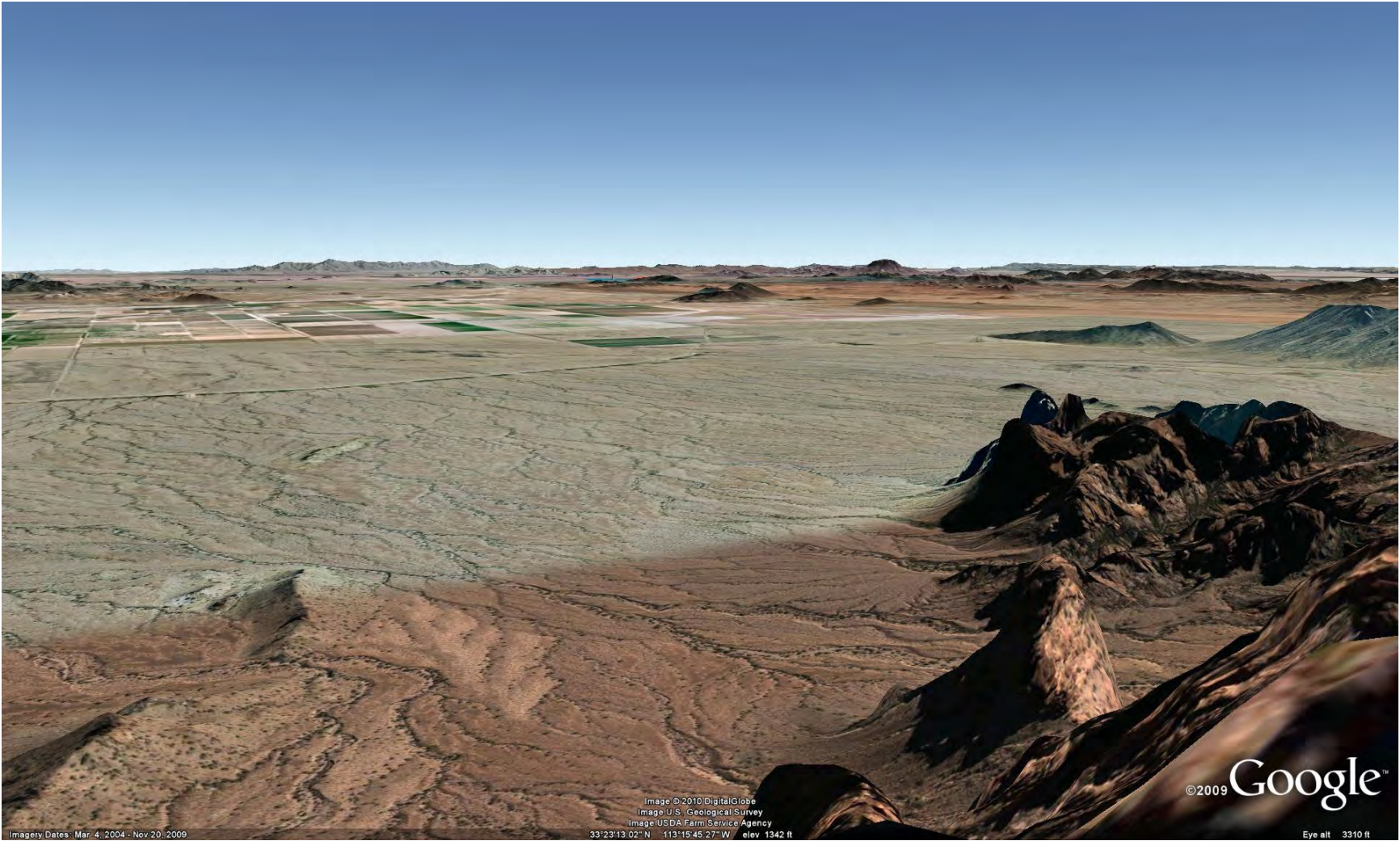


FIGURE 8.3.14.2-4 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model (shown in blue), as Seen from Eagletail Peak in Eagletail Mountains WA

1 WA, but for most viewpoints visibility would be restricted to taller solar
2 facilities. Where operating power towers within the SEZ were visible, they
3 would likely appear as distant star-like points of light against the backdrop of
4 the Gila Bend Mountains. If more than 200 ft (61 m) tall, power towers would
5 have navigation warning lights that could potentially be visible from the WA
6 at night.
7

8 Saddle Mountain and the Palo Verde Hills provide substantial partial
9 screening of the SEZ for nearly all WA viewpoints within the 25-mi (40-km)
10 SEZ viewshed. Views toward the SEZ would be oblique to the long and
11 narrow northwest–southeast axis of the SEZ, so that the SEZ would occupy a
12 relatively narrow portion of the horizontal field of view. Due to the partial
13 screening and the relatively long distance to the SEZ (22+ mi [35+ km]),
14 under the 80% development scenario analyzed in the PEIS, expected visual
15 contrast levels associated with solar energy development within the SEZ
16 would be minimal for WA viewpoints within the 25-mi (40 km) SEZ
17 viewshed.
18

- 19 • *North Maricopa Mountains*—North Maricopa Mountains is a 64,247-acre
20 (260.00-km²) congressionally designated WA located 13 mi (21 km) at the
21 point of closest approach southeast of the SEZ. The WA provides outstanding
22 opportunities for solitude and primitive recreation, including hiking,
23 backpacking, horseback riding, camping, wildlife observation and
24 photography.
25

26 Within 25 mi (40 km), solar energy facilities within the SEZ could be visible
27 from portions of the northwestern slopes of the Maricopa Mountains within
28 the WA, as well as portions of the eastern side of the Gila River valley.
29 Visible areas of the WA within the 25-mi (40-km) radius of analysis total
30 about 9,871 acres (39.95 km²) in the 650-ft (198.1-m) viewshed, or 15%
31 of the total WA acreage, and 1,650 acres (6.677 km²) in the 24.6-ft (7.5-m)
32 viewshed, or 3% of the total WA acreage. The visible area of the WA extends
33 about 23 mi (37 km) from the southern boundary of the SEZ.
34

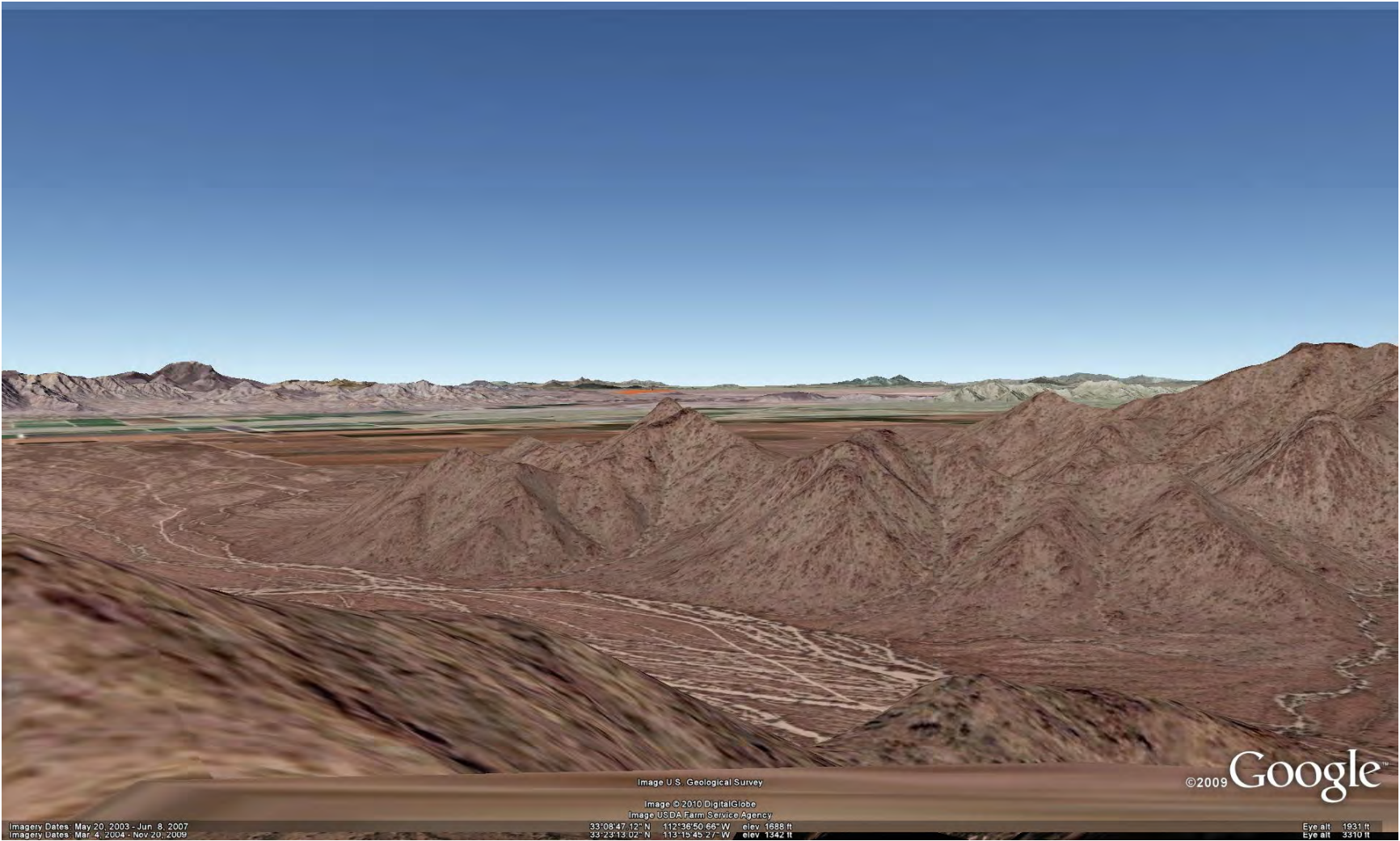
35 On the Gila River valley floor, visibility of solar facilities within the SEZ
36 would be limited to taller facility components, with visibility for most of the
37 valley floor limited to the upper portions of taller power towers. Views of the
38 SEZ from the valley floor are through a roughly 3-mi (5-km) gap between the
39 Gila Bend Mountains and the Buckeye Hills. Low hills within the gap would
40 screen views of lower-height solar facilities within the SEZ because the valley
41 floor is at nearly the same elevation as the SEZ. The SEZ would be viewed
42 along its long and narrow southeast to northwest axis and would be far enough
43 away from the viewpoint that it would occupy a very small portion of the
44 horizontal field of view. For the portions of the valley floor within the WA
45 with maximum visibility of solar development within the SEZ, transmission
46 lines, as well as the upper portions of transmission towers and power tower

1 receivers (and the tower structures), could be visible just above the horizon
2 within the gap between the Gila Bend Mountains and the Buckeye Hills. At a
3 distance of 13+ mi (21+ km), operating power tower receivers within the SEZ
4 would likely appear as points of light against a sky backdrop. If more than
5 200 ft (61 m) tall, power towers would have navigation warning lights that
6 could potentially be visible from the WA at night. Expected visual contrasts
7 would be weak at locations with maximum visibility and minimal at other
8 locations within the WA on the valley floor.
9

10 For peaks and northwest-facing ridges in the Maricopa Mountains, views of
11 the SEZ would also be through the gap between the Gila Bend Mountains and
12 the Buckeye Hills; however, the viewpoint elevations are generally high
13 enough that lower-height facilities in one or more parts of the SEZ would be
14 visible.
15

16 Figure 8.3.14.2-5 is a Google Earth visualization of the SEZ as seen from an
17 unnamed peak in the far northwestern portion of the WA, about 15 mi (24 km)
18 from the southeast corner of the SEZ, and within the WA, near the point of
19 maximum visibility of solar development within the SEZ. In the visualization,
20 the SEZ area is depicted in orange, the heliostat fields in blue.
21

22 The viewpoint in the visualization is about 960 ft (293 m) higher in elevation
23 than the SEZ. Solar facilities within the SEZ would be seen just above peaks
24 in the Maricopa Mountains between the viewpoint and the SEZ. Despite the
25 elevated viewpoint, because of the long distance to the SEZ, collector/
26 reflector arrays for solar facilities within the SEZ would be seen nearly
27 edge-on, which would reduce their apparent size and conceal their strong
28 regular geometry, and would also cause them to appear to repeat the line of
29 the valley floor in which the SEZ is located, which would tend to reduce
30 visual contrast. The SEZ is viewed along its long and narrow southeast to
31 northwest axis and is far enough away from the viewpoint that it would
32 occupy a very small portion of the horizontal field of view. Operating power
33 tower receivers within the SEZ would likely appear as points of light against
34 the floor of the valley in which the SEZ is located, or against the base of the
35 Yellow Medicine Hills or the Eagletail Mountains. If more than 200 ft (61 m)
36 tall, power towers would have navigation warning lights that could potentially
37 be visible from the WA at night. Depending on project location within the
38 SEZ, the types of solar facilities and their designs, and other visibility factors,
39 weak visual contrasts from solar energy development within the SEZ could be
40 expected at this viewpoint. Weak or minimal visual contrasts would be
41 expected for other elevated viewpoints in the Maricopa Mountains within the
42 WA.



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FIGURE 8.3.14.2-5 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Unnamed Peak in North Maricopa Mountains WA

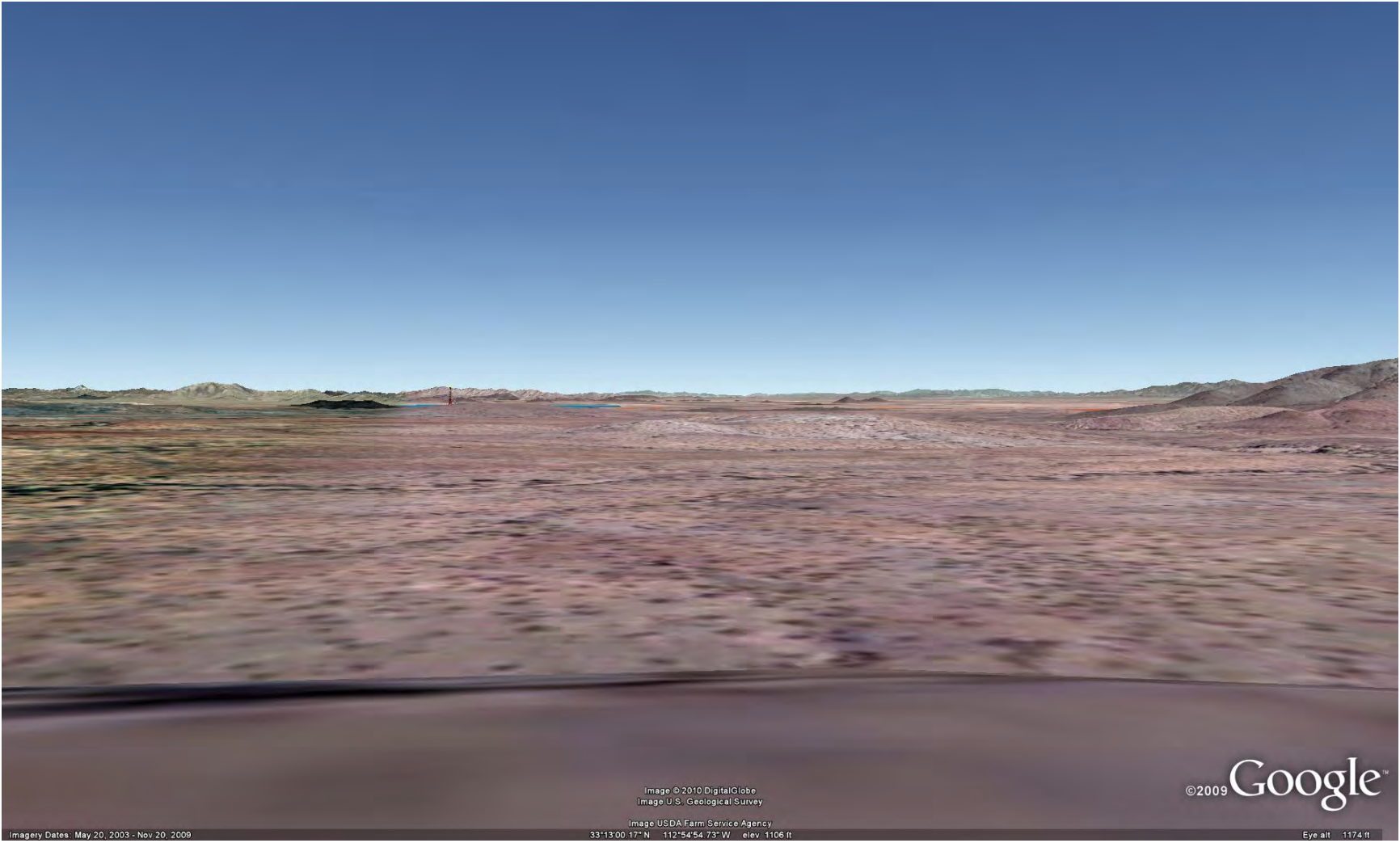
- 1 • *Signal Mountain*—Signal Mountain is a 13,467-acre (54.499-km²)
2 congressionally designated WA located 3.5 mi (5.6 km) at the point of
3 closest approach southwest of the SEZ. Scenic resources within the
4 WA include sharp volcanic peaks, steep-walled canyons, arroyos,
5 craggy ridges and outwash plains. The tallest peak in the WA, Signal
6 Mountain, rises 1,200 ft (366 m) above the desert floor to an elevation
7 of 2,182 ft (857 m). The WA provides primitive recreation
8 opportunities, such as rock climbing around Signal Mountain, hiking,
9 rock collecting, and hunting.

10
11 As shown in Figure 8.3.14.2-2, within 25 mi (40 km), solar energy facilities
12 within the SEZ could be visible primarily from portions of the northeastern
13 slopes of the mountains within the WA and from lower elevations in the far
14 northeastern section of the WA. There are isolated areas farther west and
15 south in the WA with limited visibility of the SEZ, where visibility of solar
16 facilities would be restricted to taller facility components. Visible areas of the
17 WA within the 25-mi (40-km) radius of analysis total about 2,514 acres
18 (10.17 km²) in the 650-ft (198.1-m) viewshed, or 19% of the total WA
19 acreage, and 941 acres (3.81 km²) in the 24.6-ft (7.5-m) viewshed, or 7% of
20 the total WA acreage. The visible area of the WA extends about 6.5 mi
21 (10.5 km) from the southwestern boundary of the SEZ.

22
23 Figure 8.3.14.2-6 is a Google Earth visualization of the SEZ as seen from a
24 low rise in the far northeastern portion of the WA, about 3.7 mi (6.0 km) from
25 the SEZ, and near to the closest point in the WA to the SEZ. The viewpoint is
26 within the BLM VRM program's foreground-middleground distance of 3 to
27 5 mi (5 to 8 km).

28
29 The viewpoint in the visualization is about 240 ft (73 m) higher in elevation
30 than the SEZ. Because of the small elevation difference between the
31 viewpoint and the SEZ, the vertical angle of view would be very low, and low
32 hills and ridges between the viewpoint and the SEZ would partially screen
33 lower-height solar facilities in much of the SEZ. The SEZ would be visible as
34 a very thin band of development between Webb Mountain and the Palo Verde
35 nuclear power plant. The SEZ would be viewed perpendicular to its long and
36 narrow southeast to northwest axis, and would be close enough to the
37 viewpoint that it would occupy most if not all of the horizontal field of view.

38
39 Where visible, collector/reflector arrays for solar facilities within the SEZ
40 would be seen nearly edge-on, which would reduce their apparent size,
41 conceal their strong regular geometry, and would also cause them to appear to
42 repeat the line of the valley floor in which the SEZ is located, which would
43 tend to reduce visual contrast. The screening landforms are relatively low in
44 height, so that any taller solar facility components, such as buildings, cooling
45 towers, and transmission towers, as well as any plumes would likely be
46 partially visible, and at a distance of 3 to 5 mi (6 to 9 km) could be



1

FIGURE 8.3.14.2-6 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model (shown in blue), as Seen from Low Rise in Northeastern Portion of Signal Mountain WA

1 conspicuous, depending on their location, height, and other characteristics, as
2 well as other visibility factors.

3
4 Operating power tower receivers within the SEZ would likely appear as very
5 bright, non-point light sources atop the tower structures, against a backdrop of
6 the floor of the valley in which the SEZ is located and could strongly attract
7 visual attention if located in the nearer portions of the SEZ. The tower
8 structures would add short vertical line contrasts to a predominantly horizontal
9 landscape setting. At night, if sufficiently tall, the towers would have red
10 flashing lights, or white or red flashing strobe lights that could be visually
11 conspicuous in the area's typically dark night sky conditions. Other lighting
12 associated with solar facilities could be visible as well.

13
14 Depending on project location within the SEZ, the types of solar facilities and
15 their designs, and other visibility factors, weak to strong visual contrasts from
16 solar energy development within the SEZ could be expected at this viewpoint,
17 with weaker contrast levels expected if power towers and other tall structures
18 were absent from the closest portions of the SEZ, and higher contrast levels if
19 they were present in the closest portions of the SEZ.

20
21 Figure 8.3.14.2-7 is a Google Earth visualization of the SEZ as seen from the
22 peak of Signal Mountain in the central portion of the WA, and the highest
23 elevation within the WA, located about 4.6 mi (7.5 km) from the closest point
24 in the SEZ. The viewpoint is within the BLM VRM program's foreground-
25 middleground distance of 3 to 5 mi (5 to 8 km).

26
27 The viewpoint in the visualization is about 1,240 ft (378 m) higher in
28 elevation than the SEZ. The western end of the Gila Bend Mountains would
29 screen the far eastern end of the SEZ from view. The visible portions of the
30 SEZ would be viewed perpendicular to its long and narrow southeast to
31 northwest axis, and the SEZ would be close enough to the viewpoint that it
32 would occupy most of the horizontal field of view. Solar facilities within the
33 SEZ would appear as a thin band of developed area that would stretch across
34 the horizontal field of view. Because of the large elevation difference between
35 the viewpoint and the SEZ and the relatively short distance to the SEZ, the
36 vertical angle of view would be high enough that the tops of collector/reflector
37 arrays within the SEZ would be visible, which would increase their apparent
38 size (relative to lower-angle views). The higher angle of view would also
39 make the strong regular geometry of solar collector/reflector arrays within the
40 SEZ more apparent, and they would contrast strongly with the largely natural-
41 appearing landscape.

42
43 Taller ancillary facilities, such as buildings, transmission structures, and
44 cooling towers, and plumes (if present), would likely be visible projecting
45 above the collector/reflector arrays, and their structural details could be
46 evident at least for nearby facilities. The ancillary facilities could create form

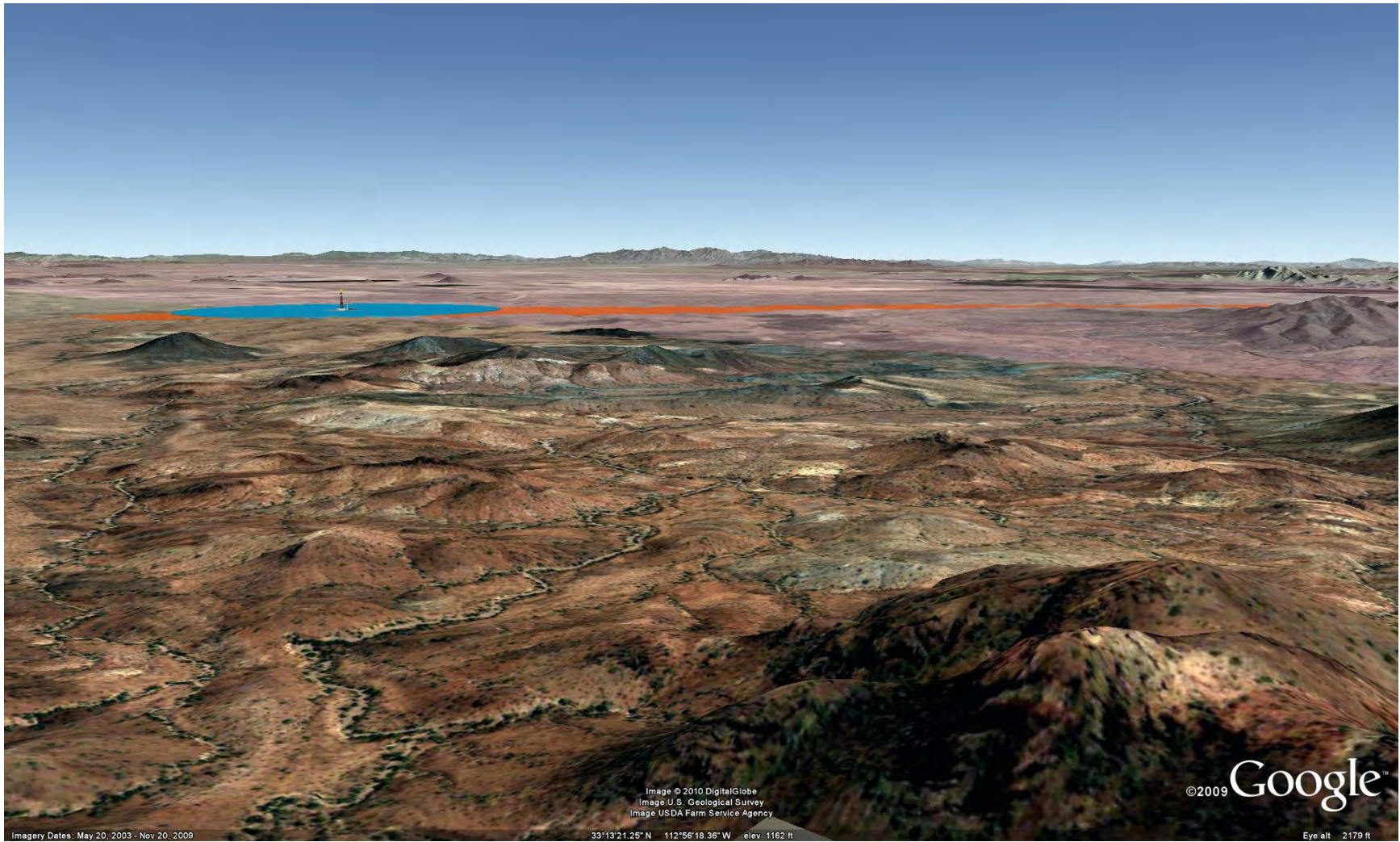


FIGURE 8.3.14.2-7 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the Peak of Signal Mountain in the Central Portion of Signal Mountain WA

1 and line contrasts with the strongly horizontal, regular, and repeating forms
2 and lines of the collector/reflector arrays. Color and texture contrasts would
3 also be likely, but their extent would depend on the materials and surface
4 treatments utilized in the facilities.
5

6 Operating power tower receivers within the SEZ would likely appear as very
7 bright, non-point light sources atop the tower structures and could strongly
8 attract visual attention if located in the nearer portions of the SEZ. The tower
9 structures would add short vertical line contrasts to a predominantly horizontal
10 landscape setting. At night, if sufficiently tall, the towers would have red
11 flashing lights, or white or red flashing strobe lights that could be visually
12 conspicuous in the area's typically dark night sky conditions, although there
13 would be other lights visible in the valley beyond the SEZ. Other lighting
14 associated with solar facilities could be visible as well.
15

16 Depending on project locations within the SEZ, the types of solar facilities
17 and their designs, and other visibility factors, under the 80% development
18 scenario analyzed in this PEIS, strong visual contrasts from solar energy
19 development within the SEZ could be expected at this viewpoint.
20

21 In summary, portions of the WA are within a relatively short distance of the
22 SEZ, and regardless of the elevation of the viewpoints, where open views of
23 the SEZ existed, viewers in these areas could be subjected to strong visual
24 contrasts from solar facilities in the SEZ. In other portions of the WA,
25 topographic screening of portions of the SEZ and of lower-height facilities
26 would tend to reduce visual contrasts levels, as would decreased elevation of
27 viewpoints and increased distance from the SEZ.
28

- 29 • *South Maricopa Mountains*—South Maricopa Mountains is a 60,446-acre
30 (244.62-km²) congressionally designated WA located 25 mi (40 km) at the
31 point of closest approach southeast of the SEZ. This wilderness includes
32 13 mi (21 km) of the Maricopa Mountain range, a low elevation Sonoran
33 Desert range, and extensive desert plains.
34

35 As shown in Figure 8.3.14.2-2, within the 25-mi (40-km) SEZ viewshed, the
36 upper portions of tall power towers located within the SEZ could be visible
37 from a very small area in the far northwestern portion of the WA. Visible
38 areas of the WA within the 25-mi (40-km) radius of analysis total about
39 3 acres (0.01 km²) in the 650-ft (198.1-m) viewshed, or 0.1% of the total WA
40 acreage. None of the WA is in the 24.6-ft (7.5-m) viewshed. The visible area
41 of the WA extends to beyond 25 mi (40 km) from the western boundary of the
42 SEZ.
43

44 Within the WA, the 3-acre (0.01 km²) area that falls within the 650-ft
45 (198.1-m) viewshed is located on the Gila River valley floor. Because of
46 nearly full screening of views to the SEZ from this area, only the upper

1 portions of operating power towers at particular locations within the SEZ
2 could be seen, and if they were located at these positions, the receivers might
3 be seen as distant star-like points of light just above the intervening
4 mountains. If more than 200 ft (61 m) tall, power towers would have
5 navigation warning lights that could potentially be visible from the WA at
6 night. Because of the very limited visibility of potential solar facilities within
7 the SEZ and very long distance to the SEZ, under the 80% development
8 scenario analyzed in this PEIS, minimal levels of visual contrast would be
9 expected from solar energy development within the SEZ, as seen from
10 viewpoints in the WA.

- 11
12 • *Woolsey Peak*—Woolsey Peak is a 64,465-acre (260.88-km²) congressionally
13 designated WA located 2.1 mi (3.4 km) at the point of closest approach south
14 of the SEZ. This wilderness encompasses a major part of the Gila Bend
15 Mountains. The diverse topography and geology include sloping lava flows,
16 basalt mesas, rugged peaks and ridges. The 3,270-ft (1,134-m) Woolsey Peak,
17 rising 2,500 ft (762 m) above the Gila River, is a geographic landmark visible
18 throughout southwestern Arizona.

19
20 As shown in Figure 8.3.14.2-2, within 25 mi (40 km), solar energy facilities
21 within the SEZ could be visible from the north- and northeast-facing slopes of
22 the mountains throughout the WA, as well as scattered areas at lower
23 elevations in the northern portion of the WA. Visible areas of the WA within
24 the 25-mi (40-km) radius of analysis total about 11,389 acres (46.090 km²) in
25 the 650-ft (198.1-m) viewshed, or 18% of the total WA acreage, and
26 4,595 acres (18.59 km²) in the 24.6-ft (7.5-m) viewshed, or 7% of the total
27 WA acreage. The visible area of the WA extends about 12.5 mi (20 km) from
28 the southern boundary of the SEZ.

29
30 Figure 8.3.14.2-8 is a Google Earth visualization of the SEZ as seen from the
31 summit of Woolsey Peak in the north-central portion of the WA, and the
32 highest elevation within the WA, located about 5.0 mi (8.0 km) from the
33 closest point in the SEZ. The viewpoint is just within the BLM VRM
34 program's foreground-middleground distance of 3-5 mi (5-8 km).

35
36 The viewpoint in the visualization is about 2,200 ft (670 m) higher in
37 elevation than the SEZ. The SEZ would appear as a thin band of development
38 just above Webb Mountain and the hills to the southeast of Webb Mountain,
39 and below the Palo Verde nuclear power plant. The SEZ would be viewed
40 roughly perpendicular to its long and narrow southeast-to-northwest axis, and
41 would be close enough to the viewpoint that it would occupy most of the
42 horizontal field of view. Because of the large elevation difference between the
43 viewpoint and the SEZ and the relatively short distance to the SEZ, the
44 vertical angle of view would be high enough that the tops of collector/reflector
45 arrays within the SEZ would be visible, which would increase their apparent

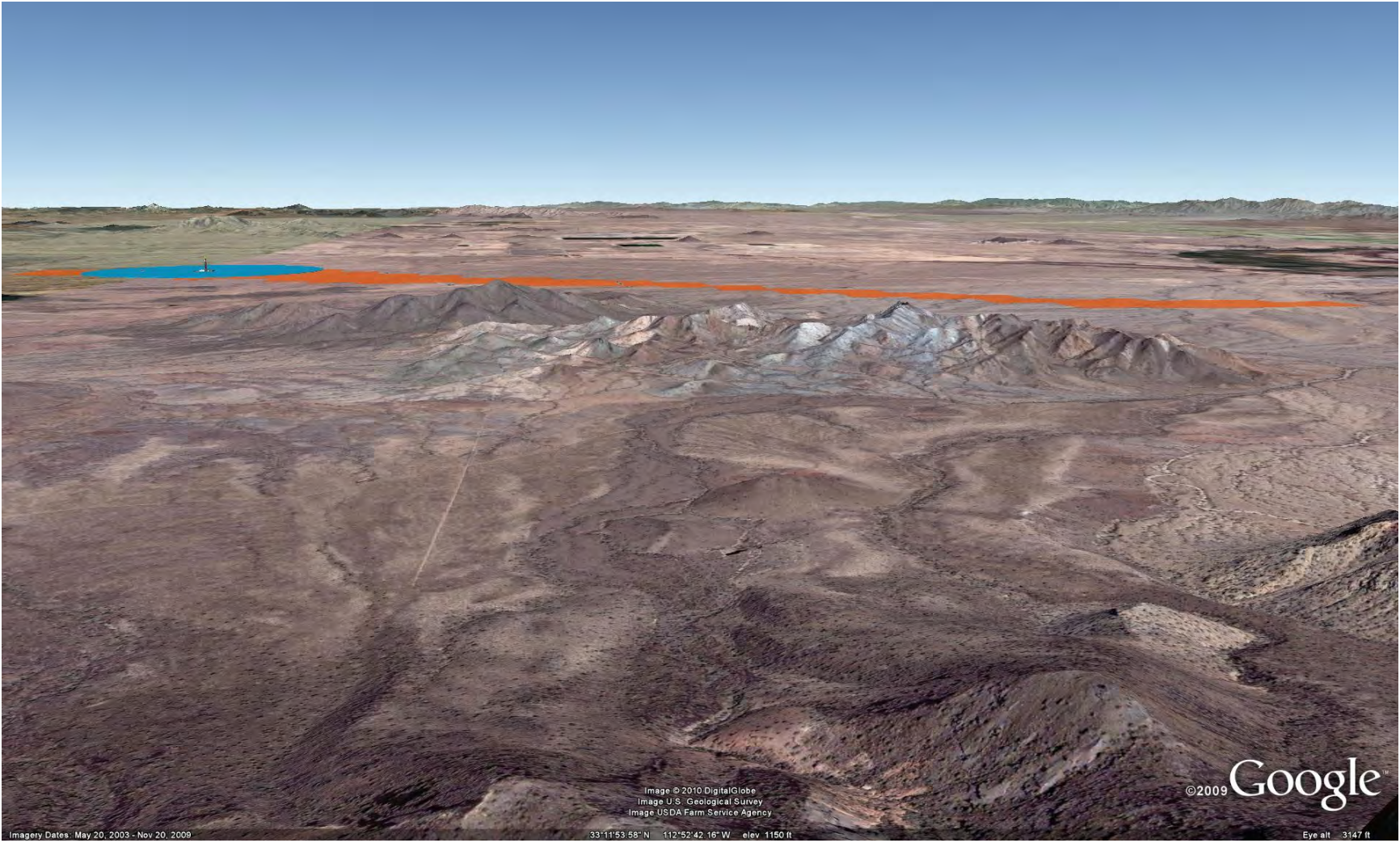


FIGURE 8.3.14.2-8 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Woolsey Peak in the Woolsey Peak WA

1 size (relative to lower-angle views). The higher angle of view would also
2 make the strong regular geometry of solar collector/reflector arrays within the
3 SEZ more apparent, and they would contrast strongly with the largely natural-
4 appearing landscape. Ancillary facilities, such as buildings, cooling towers,
5 and transmission towers, as well as any plumes, would likely be visible, and
6 could be conspicuous, depending on their location, height, and other
7 characteristics, as well as other visibility factors.
8

9 Operating power tower receivers within the SEZ would likely appear as very
10 bright, non-point (i.e., having visible cylindrical or rectangular surfaces) light
11 sources atop the tower structures and could strongly attract visual attention if
12 located in the nearer portions of the SEZ. At night, if sufficiently tall, the
13 towers would have red flashing lights, or white or red flashing strobe lights
14 that could be visually conspicuous in the area's typically dark night sky
15 conditions, although there would be other lights visible in the valley. Other
16 lighting associated with solar facilities could be visible as well.
17

18 Depending on project locations within the SEZ, the types of solar facilities
19 and their designs, and other visibility factors, under the 80% development
20 scenario analyzed in this PEIS, strong visual contrasts from solar energy
21 development within the SEZ would be expected at this viewpoint.
22

23 Figure 8.3.14.2-9 is a Google Earth visualization of the SEZ as seen from a
24 low hill in the far northeastern portion of the WA, about 3.2 mi (5.2 km) from
25 the SEZ, and just inside the WA's northern boundary. The viewpoint is within
26 the BLM VRM program's foreground-middleground distance of 3 to 5 mi
27 (5 to 8 km).
28

29 The viewpoint in the visualization is about 600 ft (183 m) higher in elevation
30 than the SEZ. Webb Mountain and the nearby hills southeast of Webb
31 Mountain would screen the western portion of the SEZ from view, more than
32 half of the total SEZ acreage. The visible portions of SEZ would be seen as a
33 very narrow band of development stretching across the valley floor, and
34 occupying much of the horizontal field of view. The SEZ would be viewed
35 roughly perpendicular to its long and narrow southeast-to-northwest axis.
36

37 Where visible, collector/reflector arrays for solar facilities within the SEZ
38 would be seen nearly edge-on. The edge-on viewing angle would reduce their
39 apparent size, conceal their strong regular geometry, and cause them to appear
40 to repeat the strong line of the horizon, tending to reduce visual contrast.
41

42 Operating power tower receivers within the SEZ would likely appear as very
43 bright, non-point light sources atop the tower structures, against a backdrop of
44 the floor of the valley in which the SEZ is located, and could strongly attract
45 visual attention if located in the nearer portions of the SEZ. At night, if
46 sufficiently tall, the towers would have red flashing lights, or white or red

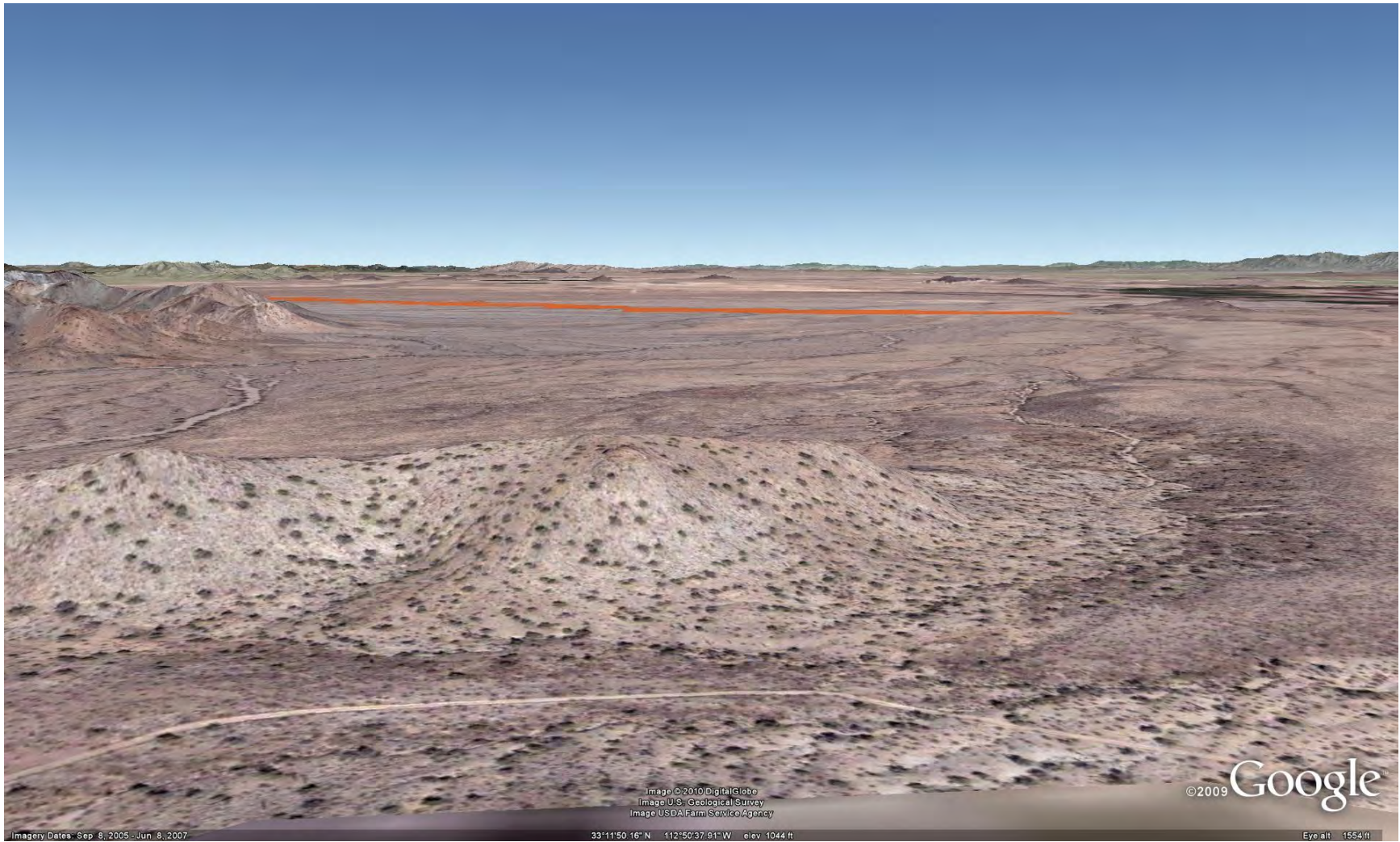


FIGURE 8.3.14.2-9 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, as Seen from a Hill in the Far Northeastern Portion of the Woolsey Peak WA

1 flashing strobe lights that could be very conspicuous from this viewpoint,
2 given the area's typically dark night sky conditions, although lights from the
3 Palo Verde nuclear power plant would be visible beyond the SEZ. Other
4 lighting associated with solar facilities could be visible as well.
5

6 Depending on project location within the SEZ, the types of solar facilities
7 and their designs, and other visibility factors, moderate to strong visual
8 contrasts from solar energy development within the SEZ could be expected at
9 this viewpoint.
10

11 Figure 8.3.14.2-10 is a Google Earth visualization of the SEZ as seen from
12 the summit of Bunyan Peak in the southwestern portion of the WA, located
13 about 11 mi (18 km) from the closest point in the SEZ.
14

15 The viewpoint in the visualization is about 1,500 ft (460 m) higher in
16 elevation than the SEZ. Signal Mountain and surrounding peaks would
17 screen the far western portion and a small part of the central portion of the
18 SEZ from view, while Webb Mountain and the hills southeast of Webb
19 Mountain would screen the eastern half of the SEZ from view. The visible
20 portions of the SEZ would be viewed roughly perpendicular to the SEZ's
21 long and narrow southeast-to-northwest axis, but because of the screening
22 and distance to the SEZ, the SEZ would occupy a small portion of the
23 horizontal field of view.
24

25 There is a relatively large elevation difference between the viewpoint and the
26 SEZ, but the SEZ is far enough away that the vertical angle of view would be
27 low. Collector/reflector arrays for solar facilities within the SEZ would be
28 seen nearly on edge, which would decrease their apparent size (relative to
29 higher-angle views), and make them appear to repeat the strong line of the
30 horizon, tending to decrease visual contrast with the surrounding landscape.
31 Ancillary facilities, such as buildings, cooling towers, and transmission
32 towers, as well as any plumes, could be visible as well.
33

34 Operating power tower receivers within the SEZ would likely appear as point
35 light sources atop the tower structures, which would likely be visible under
36 normal viewing conditions. At night, if sufficiently tall, the towers would
37 have red flashing lights, or white or red flashing strobe lights that would be
38 visible from this viewpoint, although there might be other lights visible in the
39 valley. Other lighting associated with solar facilities could be visible as well.
40

41 Depending on project locations within the SEZ, the types of solar facilities
42 and their designs, and other visibility factors, under the 80% development
43 scenario analyzed in this PEIS, weak visual contrasts from solar energy
44 development within the SEZ could be expected at this viewpoint.
45

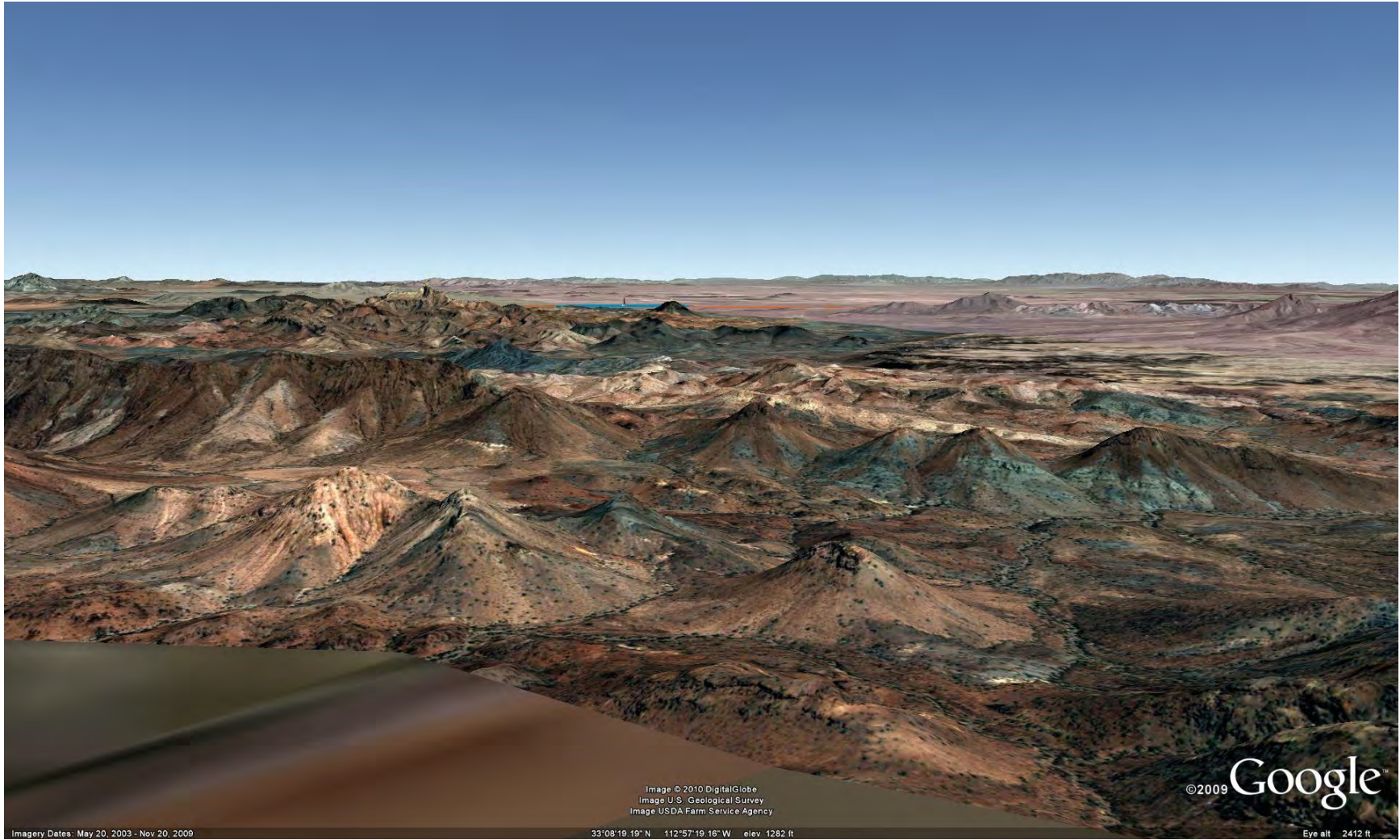


FIGURE 8.3.14.2-10 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model (shown in blue), as Seen from Bunyan Peak in the Woolsey Peak WA

1 In summary, the Woolsey Peak WA is sufficiently close to the SEZ that for
2 many viewpoints within the WA, and particularly for elevated viewpoints in
3 the northern portion of the WA, solar energy development within the SEZ
4 would be expected to result in strong visual contrast levels. Visibility of the
5
6 SEZ is not confined to the northern portions of the WA, however. Lower
7 contrast levels would be expected for lower elevation viewpoints throughout
8 the WA, and for higher elevation viewpoints deeper in the interior of the WA.
9

10 11 ***Special Recreation Management Area***

- 12
13 • *Saddle Mountain*—The Saddle Mountain SRMA is a BLM-designated SRMA
14 located 4.3 mi (6.9 km) northwest of the SEZ at the point of closest approach.
15 It encompasses 47,696 acres (193.02 km²).
16

17 As shown in Figure 8.3.14.2-2, the area of the SRMA within the 650-ft
18 (198.1-m) viewshed of the SEZ includes 27,237 acres (110.22 km²), or 57%
19 of the total SRMA acreage. The area of the SRMA within the 24.6-ft (7.5-m)
20 viewshed of the SEZ includes 19,760 acres (79.966 km²), or 41% of the total
21 SRMA acreage. The visible area extends from the point of closest approach
22 to 12 mi (19 km) into the SRMA.
23

24 The northern portions of the Saddle Mountain SRMA include Saddle
25 Mountain and the western portion of the Palo Verde Hills, but much of the
26 southern portions of the SRMA consist of relatively flat low-elevation lands
27 of the Harquahala Plains. Because the SEZ is southeast of the SRMA,
28 visibility of the SEZ within the SRMA is good, with solar development likely
29 to be plainly visible from most of the low-elevation areas in the SRMA, as
30 well as the south and east facing slopes of Saddle Mountain and the Palo
31 Verde Hills.
32

33 Figure 8.3.14.2-11 is a Google Earth visualization of the SEZ as seen from
34 the intersection of West Elliot Rd. and S. 419th Ave. in the far southeastern
35 portion of the SRMA, about 4.8 mi (7.8 km) from the SEZ and just inside the
36 SRMA's southeast boundary. The viewpoint is just within the BLM VRM
37 program's foreground-middleground distance of 3 to 5 mi (5 to 8 km).
38

39 The viewpoint in the visualization is about 25 ft (7 m) lower in elevation
40 than the nearest point in the SEZ. The SEZ would be viewed obliquely along
41 its long and narrow southeast-to-northwest axis, which would decrease the
42 apparent width of the SEZ as seen from this viewpoint. The SEZ would
43 occupy a moderate amount of the horizontal field of view. Solar facilities
44 within the SEZ would be seen in a very narrow band along the horizon at
45 the base of Webb Mountain, Woolsey Peak, and other mountains in the Gila
46 Bend range.

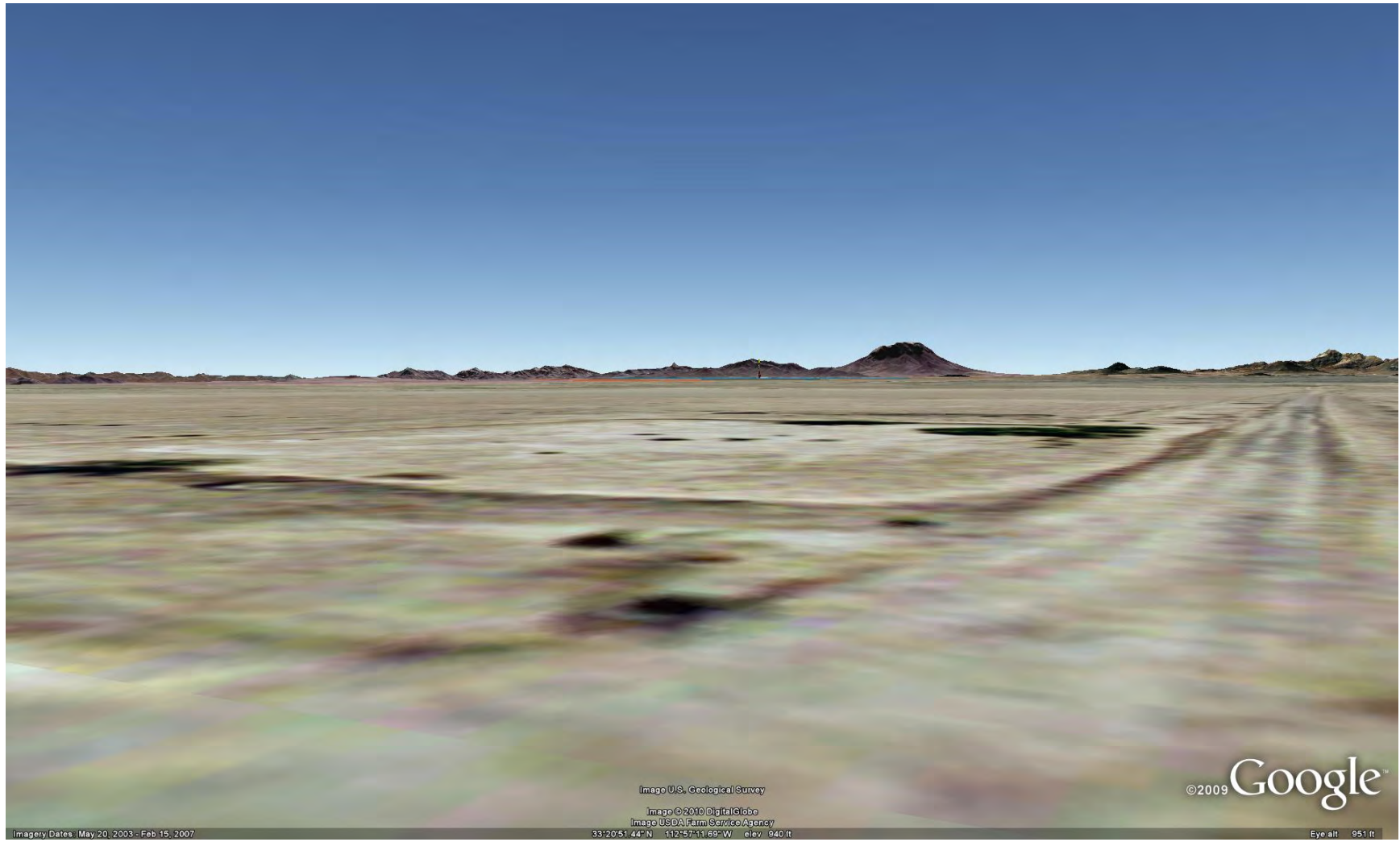


FIGURE 8.3.14.2-11 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the Intersection of West Elliot Rd. and S. 419th Ave. in the Southeastern Portion of Saddle Mountain SRMA

1 Because the viewpoint and the SEZ are at essentially the same elevation, the
2 vertical angle of view is extremely low. Collector/reflector arrays for solar
3 facilities within the SEZ would be seen edge-on, which would reduce their
4 apparent size, conceal the arrays' strong regular geometry, and would also
5 cause them to appear to repeat the strong line of the horizon, tending to
6 reduce visual contrast.

7
8 Taller ancillary facilities, such as buildings, transmission structures, and
9 cooling towers, and plumes (if present), would likely be visible projecting
10 above the collector/reflector arrays, and their structural details could be
11 evident at least for nearby facilities. The ancillary facilities could create form
12 and line contrasts with the strongly horizontal, regular, and repeating forms
13 and lines of the collector/reflector arrays. Color and texture contrasts would
14 also be likely, but their extent would depend on the materials and surface
15 treatments utilized in the facilities.

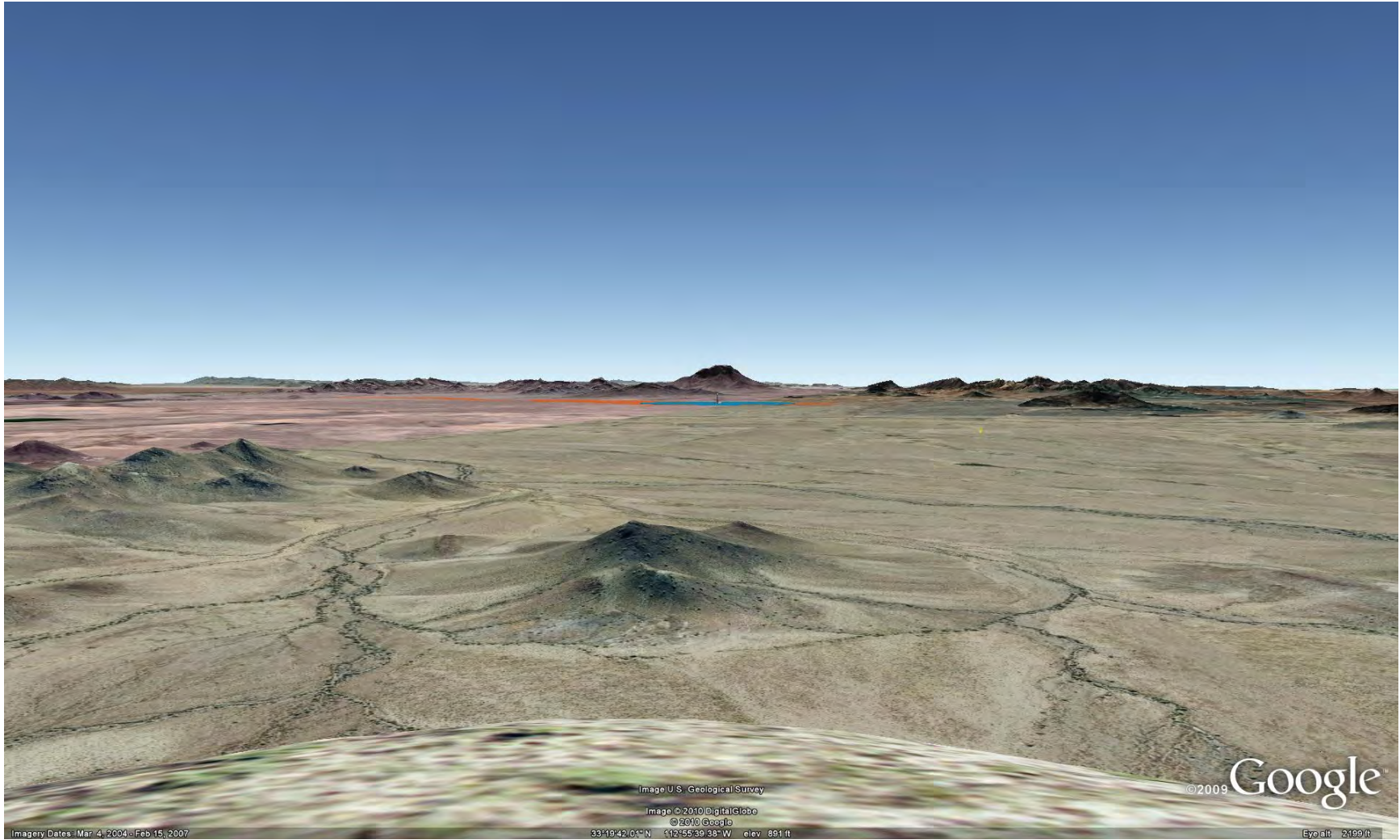
16
17 Operating power tower receivers within closer portions of the SEZ would
18 likely appear as very bright, non-point light sources atop the tower structures,
19 against a backdrop of the mountains, and could strongly attract visual
20 attention. Power tower receivers in the more distant southeast portion of the
21 SEZ (up to 11 mi [17 km] away from the viewpoint) could have substantially
22 lower levels of impact. At night, if sufficiently tall, the towers would have
23 red flashing lights, or white or red flashing strobe lights that could be
24 conspicuous as seen from this location, although other lights would be
25 visible in surrounding areas. Other lighting associated with solar facilities
26 could be visible as well.

27
28 Depending on project location within the SEZ, the types of solar facilities
29 and their designs, and other visibility factors, under the 80% development
30 scenario analyzed in this PEIS, moderate to strong visual contrasts from solar
31 energy development within the SEZ could be expected at this viewpoint.

32
33 Figure 8.3.14.2-12 is a Google Earth visualization of the SEZ as seen from
34 an unnamed peak in the northeastern portion of the SRMA, about 9.5 mi
35 (15.3 km) from the SEZ.

36
37 The viewpoint in the visualization is about 1,200 ft (370 m) higher in
38 elevation than the SEZ. The SEZ would be viewed at about a 45° angle to
39 its long and narrow southeast-to-northwest axis. The SEZ would occupy a
40 moderate amount of the horizontal field of view. Solar facilities within the
41 SEZ would be seen in a narrow, wedge-shaped band along the horizon at the
42 base of Webb Mountain, Woolsey Peak, and other mountains in the Gila
43 Bend range, with the point of the wedge toward the southeast, along the long
44 axis of the SEZ.

45



1

2

3

4

FIGURE 8.3.14.2-12 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from an Unnamed Peak in the Northeastern Portion of Saddle Mountain SRMA

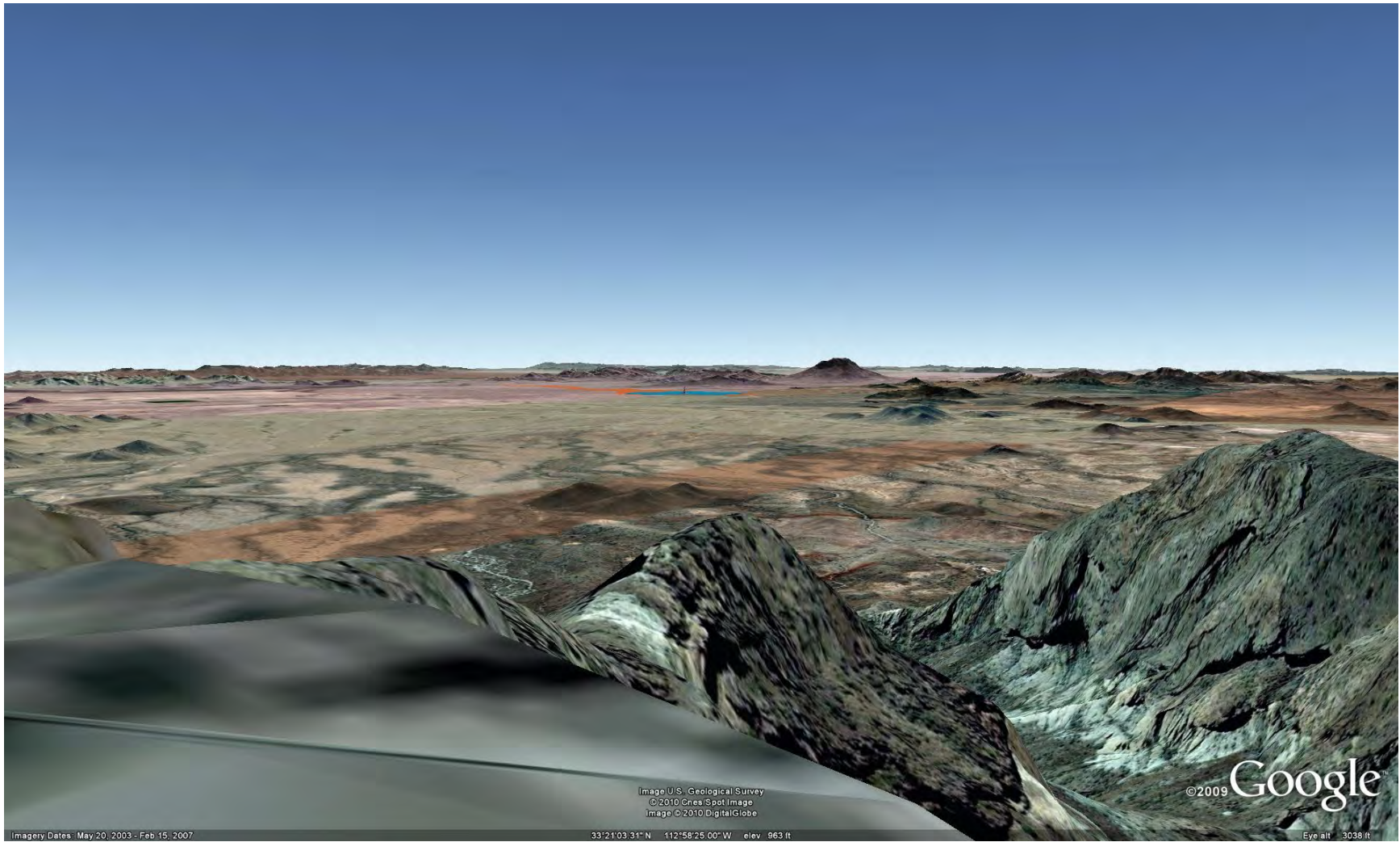
1 The viewpoint is elevated with respect to the SEZ, but because the nearest
2 point in the SEZ is about 10 mi (16 km) from the SEZ, the vertical angle of
3 view is low. Collector/reflector arrays for solar facilities within the SEZ
4 would be seen nearly edge-on, which would reduce their apparent size,
5 partially conceal the arrays' strong regular geometry, and would also cause
6 them to appear to repeat the strong line of the horizon, tending to reduce
7 visual contrast. Ancillary facilities, such as buildings, cooling towers, and
8 transmission towers, as well as any plumes, would likely be visible.
9

10 Operating power tower receivers within closer portions of the SEZ would
11 likely appear as non-point light sources atop the tower structures, against a
12 backdrop of the mountains, and could attract visual attention, depending on
13 their location within the SEZ, height, other characteristics, and visibility
14 factors. Power tower receivers (and solar facilities in general) in the more
15 distant southeast portion of the SEZ (up to almost 15 mi [24 km] away from
16 the viewpoint) would have somewhat lower levels of impact. At night, if
17 sufficiently tall, the towers would have red flashing lights, or white or red
18 flashing strobe lights that could be visually conspicuous in the area's typically
19 dark night sky conditions, although other lights, particularly those of the
20 Palo Verde nuclear power plant, would be visible in surrounding areas.
21

22 Depending on project location within the SEZ, the types of solar facilities
23 and their designs, and other visibility factors, under the 80% development
24 scenario analyzed in this PEIS, moderate visual contrasts from solar energy
25 development within the SEZ could be expected at this viewpoint.
26

27 Figure 8.3.14.2-13 is a Google Earth visualization of the SEZ as seen from
28 the summit of Saddle Mountain in the northwestern portion of the WA,
29 located about 12.6 mi (20.3 km) from the closest point in the SEZ.
30

31 The viewpoint in the visualization is about 2,100 ft (640 m) higher in
32 elevation than the SEZ. The entire SEZ would be in view. The SEZ would be
33 viewed roughly parallel to the SEZ's long and narrow southeast-to-northwest
34 axis, which would reduce the apparent width of the SEZ. The SEZ would
35 occupy a small portion of the horizontal field of view. There is a relatively
36 large elevation difference between the viewpoint and the SEZ, but the SEZ is
37 far enough away that the vertical angle of view would be low. The tops of
38 collector/reflector arrays for solar facilities within the SEZ would be visible,
39 but the arrays would be seen nearly on edge, which would decrease their
40 apparent size (relative to higher-angle views) and make them appear to repeat
41 the strong line of the horizon, tending to decrease visual contrast with the
42 surrounding landscape. Taller solar facility components, such as transmission
43 towers, could be visible, depending on lighting, but might not be noticed by
44 casual observers.
45



1

FIGURE 8.3.14.2-13 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Saddle Mountain Summit in the Saddle Mountain SRMA

2

3

4

1 Operating power tower receivers within closer portions of the SEZ would
2 likely appear as point light sources atop visible tower structures. Power tower
3 receivers (and solar facilities in general) in the more distant southeast portion
4 of the SEZ (up to almost 19 mi [30 km] away from the viewpoint) would have
5 substantially lower levels of impact. At night, if sufficiently tall, the towers
6 would have red flashing lights, or white or red flashing strobe lights visible
7 from this viewpoint, although other lights, particularly those of the Palo Verde
8 nuclear power plant, would be visible in surrounding areas.

9
10 Depending on project locations within the SEZ, the types of solar facilities
11 and their designs, and other visibility factors, under the 80% development
12 scenario analyzed in this PEIS, weak visual contrasts from solar energy
13 development within the SEZ could be expected at this viewpoint.

14
15 In summary, the Saddle Mountain SRMA is sufficiently close to the SEZ that
16 for some viewpoints within the SRMA, solar energy development within the
17 SEZ would be expected to result in moderate to strong visual contrast levels.
18 Lower contrast levels would be expected for lower elevation viewpoints
19 throughout the SRMA, and for higher elevation viewpoints in the
20 northwestern portion of the SRMA, farther from the SEZ.

21 22 23 *National Historic Trail*

- 24
25 • *Juan Bautista de Anza*—The Juan Bautista de Anza National Historic Trail
26 is a congressionally designated multistate and two-country historic trail that
27 passes within approximately 18 mi (29 km) of the SEZ at the point of closest
28 approach on the southeast side of the SEZ. Approximately 4.7 mi (7.6 km) of
29 the historic trail is located within the 650-ft (198.1-m) viewshed of the SEZ,
30 and the visible area ranges from 20.3 mi (32.7 km) southeast of the
31 southeastern boundary of the SEZ. The historic trail is not within the lower-
32 height viewsheds.

33
34 As shown in Figure 8.3.14.2-2, the portion of the historic trail within the
35 650-ft (198.1- m) SEZ viewshed is partly within and immediately west of the
36 western boundary of the Sonoran Desert National Monument (see discussion
37 above). Regardless of height, solar energy facilities within most of the SEZ
38 would be screened from view of the historic trail by the Gila Bend Mountains.
39 In the absence of vegetative or other screening, the upper portions of
40 sufficiently tall operating power towers located in the far eastern portion of
41 the SEZ could be visible just above the Gila Bend Mountains southeast of the
42 SEZ, but the SEZ would occupy a very small portion of the field of view, as it
43 would be viewed along the very narrow northwest–southeast axis, which is
44 generally less than 0.5 (0.8 km) wide. If visible within the SEZ, operating
45 power tower receivers would appear as distant lights immediately above the
46 mountains, viewed against the background of the sky. If more than 200 ft

1 (61 m) tall, power towers would have navigation warning lights that could
2 potentially be visible from the trail at night. Expected visual impacts on trail
3 users would be minimal.
4

5 Additional scenic resources exist at the national, state, and local levels, and impacts may
6 occur on both federal and nonfederal lands, including sensitive traditional cultural properties
7 important to Tribes. Note that in addition to the resource types and specific resources analyzed
8 in this PEIS, future site-specific NEPA analyses would include state and local parks, recreation
9 areas, other sensitive visual resources, and communities close enough to the proposed project to
10 be affected by visual impacts. Selected other lands and resources are included in the discussion
11 below.
12

13 In addition to impacts associated with the solar energy facilities themselves, sensitive
14 visual resources could be affected by other facilities that would be built and operated in
15 conjunction with the solar facilities. With respect to visual impacts, the most important
16 associated facilities would be access roads and transmission lines, the precise location of which
17 cannot be determined until a specific solar energy project is proposed. A 500-kV transmission
18 line runs almost adjacent to the proposed SEZ (within approximately 0.5 mi [0.8 km]), so there
19 would be minimal construction required outside of the SEZ to connect to that line. For this
20 analysis, the impacts of construction and operation of transmission lines outside of the SEZ were
21 not assessed, assuming that the existing 500-kV transmission line might be used to connect some
22 new solar facilities to load centers, and that additional project-specific analysis would be done
23 for new transmission construction or line upgrades. Roads and transmission lines would be
24 constructed within the SEZ as part of the development of the area. Note that depending on
25 project- and site-specific conditions, visual impacts associated with access roads, and particularly
26 transmission lines, could be large. Detailed information about visual impacts associated with
27 transmission lines is presented in Section 5.12.1. A detailed site-specific NEPA analysis would
28 be required to determine visibility and associated impacts precisely for any future solar projects,
29 based on more precise knowledge of facility location and characteristics.
30
31

32 **Impacts on Selected Other Lands and Resources**

33
34

35 ***Agua Caliente Road (Agua Caliente Scenic Drive).*** Agua Caliente Road, also known as
36 Agua Caliente Scenic Drive, is a 49-mi (79-km) unpaved county road that is a BLM-proposed
37 backcountry byway and a scenic, high-use travel corridor. The generally east-to-west route
38 begins off Old U.S. 80 (see impact discussion below) south of Arlington Arizona, and about
39 1.6 mi (2.6 km) from the southeastern boundary of the SEZ, Agua Caliente Road crosses the
40 SEZ three times before passing out of the SEZ viewshed west of the Yellow Medicine Hills,
41 approximately 13 mi (21 km) (by road) west of the SEZ. Approximately 18 mi (29 km) of the
42 road are within the SEZ 650-ft (198.1-m) viewshed, with about 7.3 mi (12 km) of the road within
43 the 24.6-ft (7.5-m) viewshed of the SEZ, including all of the roadway within and east of the SEZ,
44 and about 2.5 mi (4.0 km) of the road west of the SEZ. Approximately 2.2 mi (3.5 km) of the
45 road is within the SEZ.
46

1 As noted below, westbound travelers on Agua Caliente Road would already be subject
2 to large to very large visual contrasts from solar facilities within the SEZ as they approached
3 Agua Caliente Road from Old U.S. 80. As they began westward travel on Agua Caliente Road,
4 the SEZ would occupy much of the horizontal field of view, and while the viewing angle would
5 be very low because the road is lower in elevation than the SEZ in this area, the apparent size of
6 solar facilities within the SEZ and associated contrast levels would increase rapidly as the road
7 approached the SEZ, winding somewhat but heading generally west. Estimating travel speeds of
8 30 mph on the unpaved road, the SEZ would be reached in about 9 minutes.
9

10 As west-bound travelers approached the SEZ, solar facilities within the SEZ would be in
11 prominent view on the left side of vehicles. Travel would be roughly parallel to the long axis of
12 the SEZ. Facilities located within the southeastern portion of the SEZ would strongly attract the
13 eye and would dominate the view from the road. Structural details of some facility components
14 would be visible. Views of the Gila Bend Mountains could be partially screened by taller solar
15 facilities, depending on the layout of solar facilities within the SEZ. Because of the short
16 distance from the roadway, strong visual contrasts would be expected, depending on solar project
17 characteristics and project location within the SEZ.
18

19 Visual contrast would increase further as travelers entered the SEZ. If power tower
20 facilities were located in the SEZ, the operating receivers could appear as brilliant light sources
21 on either side of the road, and would likely strongly attract views during the day and, if more
22 than 200 ft (61 m) tall, would have navigation warning lights at night that could be very
23 conspicuous from the roadway. In addition, during certain times of the day from certain angles,
24 sunlight on dust particles in the air might result in the appearance of light streaming down from
25 the tower(s). Looking ahead down the road, if solar facilities were located on both the north and
26 south sides of the road, the banks of solar collectors on both sides of the byway could form a
27 visual “tunnel” that travelers would pass through briefly and successively as the road left then re-
28 entered the SEZ. If solar facilities were located close to the roadway (as they would have to be,
29 given the narrowness of the SEZ in this area), given the 80% development scenario analyzed in
30 this PEIS, they would be expected to dominate views from the road and would create strong
31 visual contrasts. After passing through the section of SEZ, the SEZ would still be very close to
32 the road on one or the other side.
33

34 As travelers approached and successively passed through the SEZ, depending on the solar
35 technologies present, facility layout, and mitigation measures employed, there would be the
36 potential for reflections from the various facility components to cause visual discomfort for
37 travelers and distraction for drivers. These potential impacts could be reduced by siting reflective
38 components away from the byway, employing various screening mechanisms, and/or adjusting
39 the mirror operations to reduce potential impacts, however, because of their height, the receivers
40 of power towers located close to the roadways could be difficult to screen.
41

42 Eastbound travelers would have a similar visual experience to westbound travelers in and
43 around the SEZ, but solar facilities in the SEZ could come into view about 13 mi (21 km) (by
44 road) west of the SEZ. For much of this distance, visibility of solar facilities within the SEZ
45 would be intermittent because of screening by the Yellow Medicine Hills and other hills near
46 Dixie Peak. In these areas, expected visual contrasts from solar facilities within the SEZ would

1 be expected to be weak. As travelers rounded the main summit in the Yellow Medicine Hills, the
2 SEZ would come into full view, at a distance of about 1.7 mi (2.7 km). The SEZ would be
3 located directly in front of east-bound vehicles, and although views would be down the long and
4 narrow northwest-southeast axis of the SEZ, visual contrasts would be strong, and would rapidly
5 increase as travelers entered the SEZ after 3 to 4 minutes.
6

7 In summary, visual contrast levels arising from solar facilities within the SEZ would vary
8 depending on viewer location and direction on Agua Caliente Road; the type, size, location, and
9 layout of solar facilities within the SEZ; and other visibility factors. However, under the 80%
10 development scenario analyzed in this PEIS, weak to strong levels of visual contrast would be
11 expected for travelers on Agua Caliente Road, primarily because the road crosses the SEZ
12 several times and otherwise passes very near the SEZ.
13

14
15 **Interstate 10.** I-10 passes within 14 mi (23 km) of the northern boundary of the proposed
16 Gillespie SEZ. The AADT value for I-10 in the vicinity of the SEZ in 2008 was about 23,000
17 (ADOT 2010).
18

19 As shown in Figure 8.3.14.2-2, within 25 mi (40 km) of the SEZ, about 25.8 mi
20 (41.5 km) of I-10 are within the SEZ viewshed. Eastbound I-10 travelers approaching Tonopah
21 from the west would be exposed to brief intermittent views of the upper parts of sufficiently tall
22 operating power towers about 7.3 mi (11.8 km) west of Tonopah, about 18 mi (29 km) from the
23 SEZ. Where visible, the operating power tower receivers would appear briefly as distant lights
24 just above the southern horizon, well way from the direction of travel. If more than 200 ft (61 m)
25 tall, power towers would have navigation warning lights that could potentially be visible from
26 the roadway at night.
27

28 About 3.6 mi (5.8 km) east of Tonopah, about 15 mi (25 km) directly north of the SEZ,
29 an extended period of visibility of lower-height solar facilities within the SEZ would begin and
30 would last until vehicles passed the community of Buckeye well east of the SEZ, although the
31 SEZ would be behind the vehicles for over half the distance. At highway speeds, the total
32 duration of views of solar facilities within the SEZ would be about 18 minutes. Near the point of
33 maximum visibility of the SEZ, the view would be roughly perpendicular to the long axis of the
34 SEZ, and the SEZ would occupy a substantial portion of the horizontal field of view; however, in
35 this area, I-10 is about 200 to 250 ft (60-75 m) higher in elevation than the SEZ, and because of
36 the long distance to the SEZ, the angle of view would be very low. In some areas, some portions
37 of the SEZ would be briefly screened from view from I-10 by intervening hills. The
38 collector/reflector arrays for solar facilities within the SEZ would be seen edge-on, so that they
39 would repeat the line of the horizon, which would tend to reduce visual contrast. If power tower
40 facilities were located within the SEZ, when operating, the receivers would likely be visible as
41 points of light against a backdrop of the Gila Bend Mountains just south of the SEZ. Because of
42 the distance to the SEZ, low viewing angle, and partial screening of the SEZ, expected visual
43 contrast levels would be weak.
44

45 Westbound travelers on I-10 would have a somewhat different visual experience of solar
46 facilities within the SEZ. Depending on their height and location within the SEZs, solar facilities

1 within the SEZ would first become visible to travelers on I-10 outside the 25-mi (40-km) radius
2 of analysis of this PEIS. However, views would be limited to the upper portions of sufficiently
3 tall power towers until lower height facilities came into view about 6 mi (10 km) northeast of the
4 community of Buckeye, almost 23 mi (37 km) northeast of the SEZ. Unlike east-bound travelers,
5 west-bound travelers would be facing the SEZ as they came into the viewshed on I-10; however,
6 because of the long distance to the SEZ and the minimal elevation difference between the SEZ
7 and I-10, the angle of view would be quite low, and expected visual contrast levels weak.

8
9 Expected visual contrast levels would rise somewhat as travelers approached the SEZ
10 over the next few minutes. Within about 5 minutes after entering the viewshed for low-height
11 solar facilities, I-10 turns to the northwest, so that travelers would for a time travel parallel to the
12 long axis of the SEZ, although at a distance of about 14 to 18 mi (22.5 to 29 km) from the SEZ.
13 Views would be similar to those for eastbound travelers, but with the SEZ visible to the left of
14 the direction of travel rather than the right.

15
16 In summary, visual contrast levels arising from solar facilities within the SEZ would vary
17 depending on viewer location and direction on I-10; the type, size, location, and layout of solar
18 facilities within the SEZ; and other visibility factors. However, under the 80% development
19 scenario analyzed in this PEIS, weak levels of visual contrast would be expected for travelers on
20 I-10, primarily because of the long distance to the SEZ (almost 15 mi [24 km] at the point of
21 maximum visibility) and the very low angle of view to the SEZ from I-10.

22
23
24 **State Route 85.** Approximately 22 mi (35 km) of State Route 85 are within the viewshed
25 of the SEZ about 11 mi (18 km) east of the SEZ. State Route 85 runs generally north–south
26 between I-8 and I-10. The AADT value for State Route 85 in the vicinity of the SEZ was about
27 11,500 vehicles in 2009 (ADOT 2010).

28
29 As shown in Figure 8.3.14.2-2, solar energy facilities within the SEZ would be visible
30 from two sections of State Route 85: a more southerly section of the road south of the Buckeye
31 Hills, where visibility would be limited to taller solar facility components; and a more northerly
32 section north of the Buckeye Hills, where lower height solar facilities within the SEZ could be
33 visible as well. The more southerly section with visibility includes about 14 mi (23 km) of the
34 roadway, while the northern section includes about 7.9 mi (13 km).

35
36 For travelers within the southern section of visibility on State Route 85, partial views of
37 taller solar energy facility components, such as power towers and transmission towers, would be
38 through a gap between the Gila Bend Mountains and the Buckeye Hills, about 2 to 3 mi (3 to
39 5 km) in width. Topography would screen lower-height facilities from view, and within much of
40 the section of road, only the upper portions of tall power towers could be visible. Views of the
41 SEZ would be along the very narrow southeast–northwest axis of the SEZ, so that the visible
42 facilities would occupy only a very small portion of the field of view. And because the SEZ and
43 the roadway are at nearly the same elevation, the angle of view would be very low, so that visible
44 collector/reflector arrays for solar facilities within the SEZ would be seen edge-on, tending to
45 reduce visual contrast. At about 11 mi (18 km) from the SEZ, operating power tower receivers
46 could appear as bright points of light viewed against a sky backdrop through the gap, and the

1 tower structure could also be visible in favorable viewing conditions. If more than 200 ft (61 m)
2 tall, power towers would have navigation warning lights that could potentially be visible from
3 the roadway at night. Other lighting associated with solar facilities could be visible as well.
4 Weak visual contrast levels would be expected. At highway speeds, view duration would be
5 about 12 minutes, with the SEZ visible to the far left of the vehicle for northbound travelers and
6 to the far right of the vehicle for southbound travelers.

7
8 Travelers on State Route 85 within the northern section of the roadway with visibility
9 to the SEZ would be able to see lower-height facilities within the SEZ, but at a very low
10 viewing angle, and at distances ranging from 13 to 19 mi (21 to 31 km). Operating power tower
11 receivers could appear as points of light viewed against a sky backdrop above the Gila Bend
12 Mountains. If more than 200 ft (61 m) tall, power towers would have navigation warning lights
13 that could potentially be visible from the roadway at night. Minimal to weak visual contrast
14 levels would be expected, with the lowest levels experienced in the northernmost part of this
15 section of State Route 85, which is farther from the SEZ. At highway speeds, view duration
16 would be about 7 minutes. The SEZ would be visible behind and to the left of the vehicle for
17 northbound travelers and in front of but to the far right of the vehicle for southbound travelers.
18 Northbound travelers would therefore be less likely to see solar facilities within the SEZ.

19
20 In summary, visual contrast levels arising from solar facilities within the SEZ would vary
21 depending on viewer location and direction on State Route 85; the type, size, location, and layout
22 of solar facilities within the SEZ; and other visibility factors, but under the 80% development
23 scenario analyzed in this PEIS, minimal to weak levels of visual contrast would be expected for
24 travelers on State Route 85, primarily because of the long distance to the SEZ and the very low
25 angle of view to the SEZ from State Route 85.

26
27
28 **Salome Highway.** Approximately 11 mi (18 km) of the Salome Highway are within the
29 viewshed of the SEZ about 9 to 10 mi (14 to 16 km) northeast of the SEZ. Salome Highway runs
30 southeast to northwest, paralleling the long axis of the SEZ.

31
32 Viewpoints to the SEZ on the Salome Highway are at approximately the same elevation
33 as the SEZ, and the angle of view is very low. Collector/reflector arrays for solar facilities within
34 the SEZ would be seen nearly edge-on, which would reduce their visible surface area and cause
35 them to appear to repeat the strong horizontal line of the horizon, thereby potentially reducing
36 visual contrast; however, because the views would be perpendicular to the long axis of the SEZ,
37 under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ would
38 occupy a substantial portion of the horizontal field of view. Taller facility components and
39 plumes could be visible above the collector/reflector arrays in favorable viewing conditions, and
40 operating power tower receivers within the SEZ would likely be visible as bright points of light
41 above visible tower structures. If more than 200 ft (61 m) tall, power towers would have
42 navigation warning lights that could potentially be visible from the roadway at night, and other
43 lighting associated with solar facilities could be visible as well. While Arlington Mesa would
44 screen some portions of the SEZ from view, in general, moderate levels of visual contrast would
45 be expected for most viewpoints on the Salome Highway.

1 **Old U.S. 80.** Approximately 29 mi (47 km) of Old U.S. 80 are within the viewshed of the
2 SEZ at distances ranging from 2 to 15 mi (3 to 24 km) southeast to northeast of the SEZ, with the
3 point of closest approach about 2 mi (3.2 km) northeast of the southeast corner of the SEZ.
4

5 Viewpoints along Old U.S. 80 are generally slightly lower in elevation than the SEZ,
6 particularly in the southern sections of the road within the SEZ viewshed. Visibility of solar
7 facilities within the SEZ within the southern 14 mi (22.5 km) of the roadway in the viewshed
8 would be limited to the upper portions of sufficiently tall power towers, which could be visible
9 through a gap between the Gila Bend Mountains and the Buckeye Hills, about 2 to 3 mi (3 to
10 5 km) in width. At longer distances from the SEZ, northbound travelers on Old U.S. 80 would
11 likely see operating power tower receivers as points of light above the Gila Bend Mountains;
12 however, they would grow in apparent size and brightness as travelers approached the SEZ. By
13 the time travelers reached the Gila River, the eastern end of the SEZ would be within the BLM
14 VRM program’s foreground-middleground distance of 5 mi (8 km). The lower portions of power
15 towers and other tall solar facilities would be screened from view. Operating power tower
16 receivers could be visible as conspicuously bright, non-point light sources that could attract
17 views, but they would not be expected to dominate views. If more than 200 ft (61 m) tall, power
18 towers would have navigation warning lights that could potentially be visible from the roadway
19 at night.
20

21 After crossing the Gila River, the SEZ would be screened from view by a low hill for 2 to
22 3 minutes but would then come back into view to the far left for viewers in northbound vehicles,
23 at a distance of about 2.2 mi (3.6 km). At this distance, the SEZ would occupy most of the
24 horizontal field of view, and while the viewing angle would be very low because the road is
25 lower in elevation than the SEZ in this area, under the 80% development scenario analyzed in
26 this PEIS, strong visual contrasts could result. In this area, southbound travelers would have even
27 more exposure to the SEZ, as the long axis of the SEZ would be more or less in front of vehicles
28 as they approached the Gila River crossing. The SEZ would fill up almost the entire horizontal
29 field of view near the point of closest approach, and structural details of facility components
30 could be visible, with taller solar facility components and plumes plainly projecting above the
31 collector/reflector arrays. Operating power tower receivers would likely be seen as very bright
32 non-point light sources, and would likely strongly command visual attention if located in the far
33 eastern portion of the SEZ. If more than 200 ft (61 m) tall, power towers would have navigation
34 warning lights that could be conspicuous from the roadway at night. Other lighting associated
35 with solar facilities could be visible as well. Under the 80% development scenario analyzed in
36 this PEIS, strong levels of visual contrast would be expected to result from solar energy
37 development within the SEZ, as seen from nearby locations on Old U.S. 80.
38
39

40 **Communities of Arlington, Palo Verde, Buckeye, and Wintersburg.** The viewshed
41 analyses indicate visibility of the SEZ from the communities of Arlington (approximately 7 mi
42 [11.3 km] northeast of the SEZ), Palo Verde (approximately 11 mi [18 km] northeast of the
43 SEZ), Buckeye (approximately 17 mi [27 km] northeast of the SEZ), and Wintersburg
44 (approximately 10 mi [16.1 km] north of the SEZ). A site visit in September 2009 indicated
45 visibility particularly from the town of Arlington. Within these communities, at least partial
46 screening of ground-level views of the SEZ are likely, due either to slight variations in

1 topography, structures, vegetation, or a combination of these screening types. A detailed future
2 site-specific NEPA analysis is required to determine visibility precisely. Even with the existing
3 screening, solar power towers, cooling towers, plumes, transmission lines and towers, or other
4 tall structures associated with the development could potentially be tall enough to exceed the
5 height of the screening and could in some cases cause visual impacts on these communities.
6

7 As shown in Figure 8.3.14.2-2, the community of Arlington is located approximately
8 7 mi (11.3 km) northeast of the SEZ. The SEZ would occupy a very large portion of the
9 horizontal field of view from viewpoints within Arlington, because views from Arlington toward
10 the SEZ would be perpendicular to the long axis of the SEZ and also because of the relatively
11 short distance to the SEZ. The elevation of Arlington is slightly lower than the SEZ, so the
12 vertical angle of view from Arlington to the SEZ would be very low. The SEZ would fill up
13 almost the entire horizontal field of view, and structural details of facility components could be
14 visible, with taller solar facility components and plumes projecting above the collector/reflector
15 arrays. Operating power tower receivers would likely be seen as very bright point or non-point
16 light sources against either a sky backdrop, or against the Gila Bend Mountains, depending on
17 their location within the SEZ. If more than 200 ft (61 m) tall, power towers would have
18 navigation warning lights that could be conspicuous as viewed from Arlington at night, and other
19 lighting associated with solar facilities could be visible as well. Under the 80% development
20 scenario analyzed in this PEIS, strong levels of visual contrast would be expected to result from
21 solar energy development within the SEZ, as seen from unscreened viewpoints within Arlington.
22

23 The community of Palo Verde is located approximately 11 mi (18 km) northeast of the
24 SEZ. The SEZ would occupy a moderate portion of the horizontal field of view from viewpoints
25 within Palo Verde. Views from Palo Verde toward the SEZ would be perpendicular to the long
26 axis of the SEZ, but the far eastern portion of the SEZ would be screened from viewpoints within
27 Palo Verde by the Buckeye Hills. The elevation of Palo Verde is slightly lower than the SEZ, so
28 the vertical angle of view from Palo Verde to the SEZ would be very low. Collector/reflector
29 arrays of solar facilities within the SEZ would be seen edge-on, which would reduce their
30 apparent size, conceal their strong regular geometry, and cause them to appear to repeat the
31 strong horizon line, tending to reduce visual contrast. Taller solar facility components and
32 plumes could be visible projecting above the collector/reflector arrays. Operating power tower
33 receivers would likely be seen as bright points of light against either a sky backdrop, or against
34 the Gila Bend Mountains, depending on their location within the SEZ. If more than 200 ft (61 m)
35 tall, power towers would have navigation warning lights that could potentially be visible from
36 Palo Verde at night. Other lighting associated with solar facilities could be visible as well. Under
37 the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be
38 expected to result from solar energy development within the SEZ, as seen from unscreened
39 viewpoints within Palo Verde.
40

41 The community of Buckeye is located approximately 17 mi (27 km) northeast of the
42 SEZ at the point of closest approach. The SEZ would occupy a small portion of the horizontal
43 field of view from viewpoints within Buckeye. Views from Buckeye toward the SEZ would be
44 perpendicular to the long axis of the SEZ, but the far eastern portion of the SEZ would be
45 screened from viewpoints within Buckeye by the Buckeye Hills. A small additional portion of
46 the SEZ would be screened by Powers Butte. The elevation of Buckeye is about the same as the

1 SEZ, so the vertical angle of view from Buckeye to the SEZ would be very low.
2 Collector/reflector arrays of solar facilities within the SEZ would be seen edge-on, which would
3 reduce their apparent size, conceal their strong regular geometry, and cause them to appear to
4 repeat the strong horizon line, tending to reduce visual contrast. Operating power tower
5 receivers would likely be seen as distant points of light against either a sky backdrop, or the
6 Gila Bend Mountains, depending on their location within the SEZ. If more than 200 ft (61 m)
7 tall, power towers would have navigation warning lights that could potentially be visible from
8 Buckeye at night. Under the 80% development scenario analyzed in this PEIS, weak levels of
9 visual contrast would be expected to result from solar energy development within the SEZ, as
10 seen from unscreened viewpoints within Buckeye.

11
12 The community of Wintersburg is located approximately 10 mi (16 km) north of the SEZ
13 at the point of closest approach. Views from Wintersburg toward the SEZ would be roughly
14 perpendicular to the long axis of the SEZ, but most of the SEZ would be screened from
15 viewpoints within Wintersburg by the Palo Verde nuclear power plant and the Palo Verde Hills.
16 The SEZ would occupy a large portion of the horizontal field of view from viewpoints within
17 Wintersburg, but only small portions of the SEZ would be visible west of the power plant and in
18 gaps between summits in the Palo Verde Hills. The elevation of Wintersburg is only slightly
19 higher than the SEZ, so the vertical angle of view from Wintersburg to the SEZ would be very
20 low. Collector/reflector arrays of solar facilities within the SEZ would be seen edge-on, conceal
21 their strong regular geometry, and cause them to appear to repeat the strong horizon line, tending
22 to reduce visual contrast. Taller solar facility components and plumes could be visible projecting
23 above the collector/reflector arrays. Operating power tower receivers would likely be seen as
24 bright points of light against the Gila Bend Mountains. If more than 200 ft (61 m) tall, power
25 towers would have navigation warning lights that could potentially be visible from Wintersburg
26 at night. Other lighting associated with solar facilities could be visible as well. Primarily because
27 of extensive screening of the SEZ as seen from Wintersburg, under the 80% development
28 scenario analyzed in this PEIS, weak levels of visual contrast would be expected to result from
29 solar energy development within the SEZ.

30
31 *Other impacts.* In addition to the impacts described for the resource areas above, nearby
32 residents and visitors to the area may experience visual impacts from solar energy facilities
33 located within the SEZ (as well as any associated access roads and transmission lines) from their
34 residences, or as they travel area roads, including but not limited to I-10, State Route 85, Salome
35 Highway, and Old U.S. 80, as noted above. The range of impacts experienced would be highly
36 dependent on viewer location, project types, locations, sizes, and layouts, as well as the presence
37 of screening, but under the 80% development scenario analyzed in the PEIS, strong visual
38 contrasts from solar development within the SEZ could potentially be observed from some
39 locations.

42 ***8.3.14.2.3 Summary of Visual Resource Impacts for the Proposed Gillespie SEZ***

43
44 The proposed Gillespie SEZ is in an area of low scenic quality and with a variety of
45 cultural disturbances visible in the surrounding areas. Because under the 80% development
46 scenario analyzed in this PEIS there could be numerous solar facilities within the SEZ, a variety

1 of technologies employed, and a range of supporting facilities that would contribute to visual
2 impacts, a visually complex, manmade-appearing industrial landscape could result. This
3 essentially industrial-appearing landscape would contrast greatly with the surrounding generally
4 natural-appearing lands. Large visual impacts on the SEZ and surrounding lands within the SEZ
5 viewshed would be associated with solar energy development within the SEZ due to major
6 modification of the character of the existing landscape. There would be additional impacts from
7 construction and operation of transmission lines and access roads within the SEZ.
8

9 Under the 80% development scenario analyzed in the PEIS, utility-scale solar energy
10 development within the proposed Gillespie SEZ is likely to result in strong visual contrasts for
11 some viewpoints within the Signal Mountain WA, which is within 3.5 mi (5.6 km) of the SEZ at
12 the point of closest approach. Strong visual contrasts could also be observed at the Woolsey Peak
13 WA, located 2.1 mi (3.4 km) from the SEZ. Moderate to strong visual contrasts could be
14 observed by visitors to the Saddle Mountain SRMA, located 4.3 mi (6.9 km) from the SEZ.
15 Minimal to weak visual contrasts would be expected for some viewpoints within other sensitive
16 visual resource areas within the SEZ 25-mi (40-km) viewshed.
17

18 Approximately 18 mi (29 km) of Agua Caliente Road (also known as the Agua Caliente
19 Scenic Drive) is within the SEZ viewshed, and approximately 2.2 mi (3.5 km) of the road is
20 within the SEZ. Because the road passes through the SEZ, strong visual contrasts could be
21 observed by road users, but because the western approach to the SEZ affords limited visibility
22 of the SEZ, much lower visual contrasts levels would be observed in those parts of the road.
23 Approximately 29 mi (47 km) of Old U.S. 80 is within the SEZ viewshed. Strong visual
24 contrasts could be observed within and near the SEZ by travelers on Old U.S. 80. Approximately
25 10.8 mi (17.4 km) of the Salome Highway is within the SEZ viewshed, and moderate visual
26 contrast would be expected for most viewpoints on the highway. Residents of nearby areas,
27 workers, and visitors to the area may experience visual impacts from solar energy facilities
28 located within the SEZ (as well as any associated access roads and transmission lines) as they
29 travel other area roads.
30

31 The communities of Arlington, Palo Verde, Buckeye, and Wintersburg are located within
32 the viewshed of the SEZ, although slight variations in topography and vegetation provide some
33 screening. Strong visual contrasts could be observed within Arlington. Weak visual contrasts
34 could be observed within the other communities.
35
36

37 **8.3.14.3 SEZ-Specific Design Features and Design Feature Effectiveness** 38

39 The presence and operation of large-scale solar energy facilities and equipment would
40 introduce major visual changes into nonindustrialized landscapes and could create strong visual
41 contrasts in line, form, color, and texture that could not easily be mitigated substantially.
42 However, the use of mitigation measures would reduce the magnitude of visual impacts
43 experienced. General mitigation measures that may apply are identified in Section 5.12.3.
44 Programmatic design features are presented in Appendix A, Section A.2.2. While the
45 applicability and appropriateness of some mitigation measures would depend on site- and
46 project-specific information that would be available only after a specific solar energy project had

1 been proposed, the following SEZ-specific measure can be identified for the proposed Gillespie
2 SEZ at this time:

- 3
4 • The development of power tower facilities should be prohibited within the
5 SEZ.
6

7 The height of solar power tower receiver structures, combined with the intense light
8 generated by the receiver atop the tower, would be expected to create strong visual contrasts that
9 could not be effectively screened from view for most areas surrounding the SEZ, given the
10 broad, flat, and generally treeless expanse of the valley in which the SEZ is located. In addition,
11 for power towers exceeding 200 ft (61 m) in height, hazard navigation lighting that could be
12 visible for very long distances would likely be required. Prohibiting the development of power
13 tower facilities would remove this source of impacts, thus substantially reducing potential visual
14 impacts on Woolsey Peak WA, the Sonoran Desert National Monument, the North Maricopa
15 Mountains WA, the Saddle Mountain SRMA, and Agua Caliente Scenic Drive.
16

17 Implementation of programmatic design features intended to reduce visual impacts
18 (described in Appendix A, Section A.2.2) would be expected to reduce visual impacts associated
19 with utility-scale solar energy development within the SEZ; however, the degree of effectiveness
20 of these design features could be assessed only at the site- and project-specific level. Given the
21 large scale, reflective surfaces, strong regular geometry of utility-scale solar energy facilities,
22 and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities
23 away from sensitive visual resource areas and other sensitive viewing areas is the primary means
24 of mitigating visual impacts. The effectiveness of other visual impact mitigation measures would
25 generally be limited.
26

1 **8.3.15 Acoustic Environment**

2
3
4 **8.3.15.1 Affected Environment**

5
6 The proposed Gillespie SEZ is located in the west-central portion of Maricopa County
7 in south-central Arizona. Neither the State of Arizona nor Maricopa County has established
8 quantitative noise-limit regulations applicable to solar energy development.
9

10 The Gillespie SEZ sits on the edge of an industrial energy zone, the overall character of
11 which is considered rural to industrial. Old U.S. 80 and State Route 85 run north–south as close
12 as 2 mi (3 km) and 10 mi (16 km) east of the SEZ, respectively. I-10 and I-8 run east–west as
13 close as about 14 mi (22.5 km) north and 20 mi (32 km) south of the SEZ, respectively. A graded
14 gravel county road goes through the western portion of the SEZ. The nearest railroads run about
15 0.5 mi (0.8 km) northwest of the SEZ and about 21 mi (34 km) south. There are several airports
16 around the SEZ: privately owned Watts Airport, about 10 mi (16 km) north; Mauldin Airstrip,
17 14 mi (23 km) north–northwest; and Pierce Airport, 15 mi (24 km) northeast. Buckeye Municipal
18 Airport is about 15 mi (24 km) northeast, while Gila Bend Municipal Airport is about 21 mi
19 (34 km) south–southeast. In addition, Gila Bend Air Force Auxiliary Field is located about 24 mi
20 (39 km) south-southeast of the SEZ. Large-scale irrigated agricultural lands are developed as
21 close as 2 mi (3 km) east along old U.S. 80. Grazing is present around the SEZ, and water
22 development has occurred on adjacent lands. To the north and east is the Palo Verde Nuclear
23 Generating Station, three natural gas–fired power plants, an occupied transmission line corridor,
24 several natural gas pipelines and a compressor station, landfills (owned by the City of Phoenix
25 and one private), and Arizona State Prison Complex–Lewis. No sensitive receptors (e.g.,
26 residences, hospitals, schools, or nursing homes) exist around the proposed Gillespie SEZ. The
27 nearest residences are about 1.8 mi (2.9 km) east–northeast of the southeastern boundary of the
28 SEZ. The nearest population center with schools is Arlington, about 7 mi (11 km) northeast of
29 the SEZ. Accordingly, noise sources around the SEZ include road traffic, railroad traffic, aircraft
30 flyover, agricultural activities, animal grazing, and industrial activities. To date, no
31 environmental noise survey has been conducted in the vicinity of the proposed Gillespie SEZ.
32 On the basis of the population density, the day-night average noise level (L_{dn} or DNL) is
33 estimated to be 47 dBA for Maricopa County, in the upper end of the range of 33 to 47 dBA L_{dn}
34 typical of a rural area (Eldred 1982; Miller 2002).¹¹
35
36

37 **8.3.15.2 Impacts**

38
39 Potential noise impacts associated with solar projects in the Gillespie SEZ would occur
40 during all phases of the projects. During the construction phase, potential noise impacts
41 associated with operation of heavy equipment and vehicular traffic on the nearest residences
42 (about 1.8 mi [2.9 km] to the southeastern boundary of the SEZ) would be anticipated, albeit of

¹¹ Rural and undeveloped areas have sound levels in the range of 33 to 47 dBA as L_{dn} (Eldred 1982). Typically, nighttime levels are 10 dBA lower than daytime levels, and they can be interpreted as 33 to 47 dBA (mean 40 dBA) during daytime hours and 23 to 37 dBA (mean 30 dBA) during nighttime hours.

1 short duration. During the operations phase, potential impacts on nearby residences would be
2 anticipated, depending on the solar technologies employed. Noise impacts shared by all solar
3 technologies are discussed in detail in Section 5.13.1, and technology-specific impacts are
4 presented in Section 5.13.2. Impacts specific to the proposed Gillespie SEZ are presented in this
5 section. Any such impacts would be minimized through the implementation of required
6 programmatic design features described in Appendix A, Section A.2.2, and through any
7 additional SEZ-specific design features applied (see Section 8.3.15.3 below). This section
8 discusses potential noise impacts on human beings only. Potential noise impacts on wildlife is
9 presented in Section 5.10.2.

12 **8.3.15.2.1 Construction**

14 The proposed Gillespie SEZ has a relatively flat terrain; thus, minimal site preparation
15 activities would be required, and associated noise levels would be lower than those during
16 general construction (e.g., erecting building structures and installing equipment, piping, and
17 electrical).

18
19 For the parabolic trough and power tower technologies, the highest construction noise
20 levels would occur at the power block area, where key components (e.g., steam turbine/
21 generator) needed to generate electricity are located; a maximum of 95 dBA at a distance of
22 50 ft (15 m) is assumed, if impact equipment such as pile drivers or rock drills is not being used.
23 Typically, the power block area is located in the center of the solar facility, at a distance of more
24 than 0.5 mi (0.8 km) from the facility boundary. Noise levels from construction of the solar array
25 would be lower than 95 dBA. When geometric spreading and ground effects are considered, as
26 explained in Section 4.13.1, noise levels would attenuate to about 40 dBA at a distance of
27 1.2 mi (1.9 km) from the power block area. This noise level is typical of daytime mean rural
28 background levels. In addition, mid- and high-frequency noise from construction activities is
29 significantly attenuated by atmospheric absorption under the low-humidity conditions typical of
30 an arid desert environment and by temperature lapse conditions typical of daytime hours; thus,
31 noise attenuation to a 40-dBA level would occur at distances somewhat shorter than 1.2 mi
32 (1.9 km). If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA
33 L_{dn} for residential areas (EPA 1974) would occur about 1,200 ft (370 m) from the power block
34 area, which would be well within the facility boundary. For construction activities occurring
35 near the residences closest to the southeastern boundary of the SEZ, estimated noise levels at
36 the nearest residences would be about 35 dBA, which is below the typical daytime mean rural
37 background level of 40 dBA. This noise might be masked to some extent by noises from road
38 traffic on old U.S. 80 and other nearby industrial and agricultural activities. In addition, an
39 estimated 41 dBA L_{dn} at these residences¹² is well below the EPA guideline of 55 dBA L_{dn} for
40 residential areas.

41
42 In addition, noise levels were estimated at the specially designated areas within a 5-mi
43 (8-km) range of the proposed Gillespie SEZ, which is the farthest distance at which noise (other

¹² For this analysis, background levels of 40 and 30 dBA for daytime and nighttime hours, respectively, were conservatively assumed, which result in a day-night average noise level (L_{dn}) of 40 dBA.

1 than extremely loud noise) would be discernable. There are three specially designated areas
2 within this area: Woolsey Peak WA, Signal Mountain WA, and Saddle Mountain SRMA, located
3 about 2.1 mi (3.4 km) south, 3.5 mi (5.6 km) southwest, and 4.3 mi (6.9 km) northwest of the
4 SEZ, respectively. For construction activities occurring near the specially designated areas, noise
5 levels are estimated to be about 34, 28, and 26 dBA at the boundaries of Woolsey Peak WA,
6 Signal Mountain WA, and Saddle Mountain SRMA, respectively, all of which are below the
7 typical daytime mean rural background level of 40 dBA. Therefore, construction noise from the
8 SEZ is not likely to adversely affect any of the nearby specially designated areas
9 (Manci et al. 1988), as discussed in Section 5.10.2.

10
11 Depending on soil conditions, pile driving might be required for installation of solar dish
12 engines. However, the pile drivers used, such as vibratory or sonic drivers, would be relatively
13 small and quiet, in contrast to the impulsive impact pile drivers frequently seen at large-scale
14 construction sites. Potential impacts on the nearest residences would be anticipated to be
15 negligible, considering the distance (about 1.8 mi [2.9 km] from the SEZ boundary).

16
17 It is assumed that most construction activities would occur during the day, when noise is
18 better tolerated than at night because of the masking effects of background noise. In addition,
19 construction activities for a utility-scale facility are temporary (typically a few years).
20 Construction within the proposed Gillespie SEZ would cause minor but unavoidable and
21 localized short-term noise impacts on neighboring communities, even when construction
22 occurs near the southeastern boundary of the SEZ, close to the nearest residences.

23
24 Construction activities could result in various degrees of ground vibration, depending
25 on the equipment used and construction methods employed. All construction equipment causes
26 ground vibration to some degree, but activities that typically generate the most severe vibrations
27 are high-explosive detonations and impact pile driving. As is the case for noise, vibration would
28 diminish in strength with distance. For example, vibration levels at receptors beyond 140 ft
29 (43 m) from a large bulldozer (87 VdB at 25 ft [7.6 m]) would diminish below the threshold of
30 perception for humans, which is about 65 VdB (Hanson et al. 2006). During the construction
31 phase, no major construction equipment that can cause ground vibration would be used, and no
32 residences or sensitive structures are close. Therefore, no adverse vibration impacts are
33 anticipated from construction activities, including pile driving for dish engines.

34
35 Construction of a new transmission line has not been assessed for the Gillespie SEZ,
36 assuming connection to the existing 500-kV line would be possible; impacts on the acoustic
37 environment would be evaluated at the project-specific level if new transmission construction or
38 line upgrades were to occur. In addition, some construction of transmission lines could occur
39 within the SEZ and over a short distance (0.6 mi [1.0 km]) to the regional grid. Potential noise
40 impacts on nearby residences from such construction would be a minor, temporary component of
41 construction impacts.

1 **8.3.15.2.2 Operations**
2

3 Noise sources common to all or most types of solar technologies include equipment
4 motion from solar tracking, maintenance and repair activities (e.g., washing mirrors or replacing
5 broken mirrors) at the solar array area, commuter/visitor/support/delivery traffic within and
6 around the solar facility, and control/administrative buildings, warehouses, and other auxiliary
7 buildings/structures. Diesel-fired emergency power generators and firewater pump engines
8 would be additional sources of noise, but their operations would be limited to several hours per
9 month (for preventive maintenance testing).
10

11 For the main solar energy technologies, noise-generating activities in the PV solar array
12 area would be minimal, related mainly to solar tracking, if used. On the other hand, dish engine
13 technology, which employs collector and converter devices in a single unit, generally has the
14 strongest noise sources.
15

16 For the parabolic trough and power tower technologies, most noise sources during
17 operations would be in the power block area, including the turbine generator (typically in an
18 enclosure), pumps, boilers, and dry- or wet-cooling systems. The power block is typically
19 located in the center of the facility. On the basis of a 250-MW parabolic trough facility with a
20 cooling tower (Beacon Solar, LLC 2008), simple noise modeling indicates that noise levels
21 around the power block would be more than 85 dBA, but about 51 dBA at the facility boundary,
22 about 0.5 mi (0.8 km) from the power block area. For the power block near the southeastern
23 boundary of the SEZ (no 0.5-mi [0.8-km] buffer distance due to a narrow strip of the SEZ), the
24 predicted noise level would be about 39 dBA at the nearest residences, about 1.8 mi (2.9 km)
25 from the SEZ boundary, which is comparable to the typical daytime mean rural background level
26 of 40 dBA. However, this noise might be masked to some extent by noises from road traffic on
27 old U.S. 80 and other nearby industrial and agricultural activities. If TES were not used (i.e., if
28 the operation were limited to daytime, 12 hours only¹³), the EPA guideline level of 55 dBA (as
29 L_{dn} for residential areas) would occur at about 1,370 ft (420 m) from the power block area and
30 thus would be just outside the proposed boundary of the SEZ. At the nearest residences, about
31 41 dBA L_{dn} would be estimated, which is well below the EPA guideline of 55 dBA L_{dn} for
32 residential areas. However, day-night average noise levels higher than those estimated above by
33 using simple noise modeling would be anticipated if TES were used during nighttime hours, as
34 explained below and in Section 4.13.1.
35

36 On a calm, clear night typical of the proposed Gillespie SEZ setting, the air temperature
37 would likely increase with height (temperature inversion) because of strong radiative cooling.
38 Such a temperature profile tends to focus noise downward toward the ground. There would be
39 little, if any, shadow zone¹⁴ within 1 or 2 mi (1.6 or 3 km) of the noise source in the presence of
40 a strong temperature inversion (Beranek 1988). In particular, such conditions add to the effect of
41 noise being more discernable during nighttime hours, when the background noise levels are

13 Twelve hours is the maximum possible number of operating hours at the summer solstice, but 7 to 8 hours is the maximum at the winter solstice.

14 A shadow zone is defined as the region in which direct sound does not penetrate because of upward diffraction.

1 lowest. To estimate the day-night average noise level (L_{dn}), 6-hour nighttime generation with
2 TES is assumed after 12-hour daytime generation. For nighttime hours under temperature
3 inversion, 10 dB is added to noise levels estimated from the uniform atmosphere
4 (see Section 4.13.1). On the basis of these assumptions, the estimated nighttime noise level at the
5 nearest residences (about 1.8 mi [2.9 km] from the SEZ boundary) would be 49 dBA, which is
6 well above the typical nighttime mean rural background level of 30 dBA. The day-night average
7 noise level is estimated to be about 51 dBA L_{dn} , which is below the EPA guideline of 55 dBA
8 L_{dn} for residential areas. These assumptions were conservative in terms of operating hours, and
9 no credit was given to other attenuation mechanisms, so it is likely that noise levels would be
10 lower than 51 dBA L_{dn} at the nearest residences, even if TES were used at a solar facility.
11 Consequently, operating parabolic trough or power tower facilities using TES and located near
12 the southeastern boundary of the SEZ could result in some noise impacts on the nearest
13 residences, depending on background noise levels and meteorological conditions.

14
15 Estimated noise levels associated with the operation of a parabolic trough or power tower
16 solar facility would be about 37, 32, and 30 dBA at the boundaries of Woolsey Peak WA, Signal
17 Mountain WA, and Saddle Mountain SRMA, respectively, all of which are below the typical
18 daytime mean rural background level of 40 dBA. Therefore, operation noise from the SEZ is not
19 likely to adversely affect any of nearby specially designated areas (Manci et al. 1988).

20
21 In the permitting process, refined noise propagation modeling would be warranted along
22 with measurement of background noise levels.

23
24 The solar dish engine is unique among CSP technologies, because it generates electricity
25 directly and does not require a power block. A single, large solar dish engine has relatively low
26 noise levels, but a solar facility might employ tens of thousands of dish engines, which would
27 cause high noise levels around such a facility. For example, the proposed 750-MW SES Solar
28 Two dish engine facility in California would employ as many as 30,000 dish engines (SES Solar
29 Two, LLC 2008). At the proposed Gillespie SEZ, on the basis of the assumption of dish engine
30 facilities of up to 233-MW total capacity (covering 80% of the total area, or 2,094 acres
31 [8.47 km²]), up to 9,308 25-kW dish engines could be employed. For a large dish engine facility,
32 about 100 step-up transformers would be embedded in the dish engine solar field, along with
33 a substation; however, the noise from these sources would be masked by dish engine noise.

34
35 The composite noise level of a single dish engine would be about 88 dBA at a distance of
36 3 ft (0.9 m) (SES Solar Two, LLC 2008). This noise level would be attenuated to about 40 dBA
37 (typical of the mean rural daytime environment) within 330 ft (100 m). However, the combined
38 noise level from hundreds of thousands of dish engines operating simultaneously would be high
39 in the immediate vicinity of the facility, for example, about 47 dBA at 1.0 mi (1.6 km) and
40 42 dBA at 2 mi (3 km) from the boundary of the square-shaped dish engine solar field; both
41 values are higher than the typical daytime mean rural background level of 40 dBA. However,
42 these levels would occur at somewhat shorter distances than the aforementioned distances,
43 considering noise attenuation by atmospheric absorption and temperature lapse during daytime
44 hours. To estimate noise levels at the nearest residences, it was assumed dish engines were
45 placed all over the Gillespie SEZ at intervals of 98 ft (30 m). Under these assumptions, the
46 estimated noise level at the nearest residences, about 1.8 mi (2.9 km) from the SEZ boundary,

1 would be about 38 dBA, which is below the typical daytime mean rural background level of
2 40 dBA. This noise might be masked to some extent by noises from road traffic on old U.S. 80
3 and other nearby industrial and agricultural activities. On the basis of 12-hr daytime operation,
4 the estimated 41 dBA L_{dn} at these residences is well below the EPA guideline of 55 dBA L_{dn} for
5 residential areas. On the basis of other noise attenuation mechanisms, noise levels at the nearest
6 residences would be lower than the values estimated above. However, noise from dish engines
7 could cause adverse impacts on the nearest residences, depending on background noise levels
8 and meteorological conditions.

9
10 For dish engines placed all over the SEZ, estimated noise levels would be about 39, 38,
11 and 34 dBA at the boundaries of Woolsey Peak WA, Signal Mountain WA, and Saddle
12 Mountain SRMA, respectively, all of which are below the typical daytime mean rural
13 background level of 40 dBA. Therefore, dish engine noise from the SEZ is not likely to
14 adversely affect any of nearby specially designated areas (Manci et al. 1988).

15
16 Consideration of minimizing noise impacts is very important during the siting of dish
17 engine facilities. Direct mitigation of dish engine noise through noise control engineering could
18 also limit noise impacts.

19
20 During operations, no major ground-vibrating equipment would be used. In addition,
21 no sensitive structures are located close enough to the proposed Gillespie SEZ to experience
22 physical damage. Therefore, during operation of any solar facility, potential vibration impacts
23 on surrounding communities and vibration-sensitive structures would be negligible.

24
25 Transformer-generated humming noise and switchyard impulsive noises would be
26 generated during the operation of solar facilities. These noise sources would be located near the
27 power block area, typically near the center of a solar facility. Noise from these sources would
28 generally be limited within the facility boundary and not be heard at the nearest residences,
29 assuming a 1.8-mi (2.9-km) distance (for the power block next to the southeastern boundary of
30 the SEZ). Accordingly, potential impacts of these noise sources on the nearest residences would
31 be negligible.

32
33 For impacts from transmission line corona discharge noise during rainfall events
34 (Section 5.13.1.5), the noise level at 50 ft (15 m) and 300 ft (91 m) from the center of a 230-kV
35 transmission line tower would be about 39 and 31 dBA (Lee et al. 1996), respectively, typical of
36 daytime and nighttime mean background noise levels in rural environments. The noise levels at
37 65 ft (20 m) and 300 ft (91 m) from the center of 500-kV transmission line towers would be
38 about 49 and 42 dBA, typical of high-end and mean, respectively, daytime background noise
39 levels in rural environments. Corona noise includes high-frequency components, which may be
40 judged to be more annoying than other environmental noises. However, corona noise would not
41 likely cause impacts, unless a residence was located close to the source (e.g., within 500 ft
42 [152 m] of a 230-kV transmission line and 0.5 mi [0.8 km] of a 500-kV transmission line). The
43 proposed Gillespie SEZ is located in an arid desert environment, and incidents of corona
44 discharge would be infrequent. Therefore, potential impacts on nearby residents along the
45 transmission line ROW would be negligible.

1 **8.3.15.2.3 Decommissioning/Reclamation**
2

3 Decommissioning/reclamation requires many of the same procedures and equipment
4 used in traditional construction. Decommissioning/reclamation would include dismantling of
5 solar facilities and support facilities such as buildings/structures and mechanical/electrical
6 installations, disposal of debris, grading, and revegetation as needed. Activities for
7 decommissioning would be similar to those for construction but more limited. Potential
8 noise impacts on surrounding communities would be correspondingly lower than those for
9 construction activities. Decommissioning activities would be of short duration, and their
10 potential impacts would be minor and temporary. The same mitigation measures adopted
11 during the construction phase could also be implemented during the decommissioning phase.
12

13 Similarly, potential vibration impacts on surrounding communities and vibration-
14 sensitive structures during decommissioning of any solar facility would be lower than those
15 during construction and thus negligible.
16

17
18 **8.3.15.3 SEZ-Specific Design Features and Design Feature Effectiveness**
19

20 The implementation of required programmatic design features described in Appendix A,
21 Section A.2.2, would greatly reduce or eliminate the potential for noise impacts from
22 development and operation of solar energy facilities. While some SEZ-specific design features
23 are best established when specific project details are being considered, measures that can be
24 identified at this time include the following:
25

- 26 • Noise levels from cooling systems equipped with TES should be managed so
27 that levels at the nearest residences to the east of the SEZ are kept within
28 applicable guidelines. This could be accomplished in several ways, for
29 example, through placing the power block approximately 1 to 2 mi (1.6 to
30 3 km) or more from residences, limiting operations to a few hours after sunset,
31 and/or installing fan silencers.
32
- 33 • Dish engine facilities within the Gillespie SEZ should be located more than 1
34 to 2 mi (1.6 to 3 km) from the nearest residences (i.e., the facilities should be
35 located in the central or northwestern portion of the proposed SEZ). Direct
36 noise control measures applied to individual dish engine systems could also be
37 used to reduce noise impacts at the nearest residences.
38

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1 **8.3.16 Paleontological Resources**

2
3
4 **8.3.16.1 Affected Environment**

5
6 The surface geology of the proposed Gillespie SEZ is composed predominantly of
7 residual materials developed in sedimentary rocks. These discontinuous residual deposits
8 account for 1,427 acres (5.8 km²), or 55% of the SEZ. Portions of the SEZ are composed of
9 more than 100-ft (30-m) thick alluvial deposits ranging in age from the Pliocene to Holocene.
10 The alluvial deposits cover 1,191 acres (4.8 km²), or 45%, of the SEZ. In the absence of a
11 PFYC map for Arizona, a preliminary classification of PFYC Class 3b is assumed for the alluvial
12 deposits and the residual materials (see also Sections 8.1.16.1 and 8.2.16.1). Class 3b indicates
13 that the potential for the occurrence of significant fossil materials is unknown and needs to be
14 investigated further (see Section 4.14 for a discussion of the PFYC system). There is also a
15 potential for Miocene fauna from the basin fill deposits. Rhinoceros and camel have been
16 documented at Anderson Mine in southwestern Yavapai County (Morgan and White 2005).
17 These finds indicate the potential for other similar finds in the region.
18

19
20 **8.3.16.2 Impacts**

21
22 The potential for impacts on significant paleontological resources in the proposed SEZ
23 is unknown. A more detailed investigation of the discontinuous residual materials developed
24 in sedimentary rocks as well as the alluvial deposits is needed prior to project approval. A
25 paleontological survey will likely be needed following consultation with the BLM. The
26 appropriate course of action would be determined as established in BLM IM2008-9 and
27 IM2009-011 (BLM 2007b, 2008b). Section 5.14 discusses the types of impacts that could occur
28 on any significant paleontological resources found within the Gillespie SEZ. Impacts would be
29 minimized through the implementation of required programmatic design features described in
30 Appendix A, Section A.2.2.
31

32 Indirect impacts on paleontological resources outside of the SEZ, such as through looting
33 or vandalism, are unknown but possible if any such resources are at or near the surface. Areas
34 adjacent to the SEZ should be investigated for surface outcrops of potential fossil-bearing
35 formations during the paleontological survey of the SEZ. Programmatic design features for
36 controlling water runoff and sedimentation would prevent erosion-related impacts on buried
37 deposits outside of the SEZ.
38

39 Approximately 3 mi (5 km) of new road is anticipated to be needed to access the
40 proposed Gillespie SEZ from Old Highway 80, resulting in about 22 acres (0.09 km²) of
41 disturbance to alluvial sediments (classified as PFYC Class 3b deposits) and volcanic rocks
42 (classified as PFYC Class 1) east of the SEZ. Class 1 indicates that the occurrence of significant
43 fossils is nonexistent or extremely rare. The potential for impacts on significant paleontological
44 resources in the anticipated access road corridor is unknown for the alluvial deposits and very
45 low for the volcanic areas. Similar to the SEZ footprint, a more detailed investigation of the
46 alluvial deposits is needed and a paleontological survey will likely be required, but no further

1 work is anticipated for the PFYC Class 1 volcanic areas. No new transmission lines are currently
2 anticipated for the Gillespie SEZ, assuming the existing transmission system would be used;
3 therefore, no impacts on paleontological resources are anticipated related to the creation of new
4 transmission corridors. However, impacts on paleontological resources related to the creation of
5 new corridors not assessed in this PEIS would be evaluated at the project-specific level if new
6 road or transmission construction or line upgrades are to occur.

7
8 Programmatic design features requiring a stop-work order in the event of an inadvertent
9 discovery of paleontological resources would reduce impacts by preserving some information
10 and allowing possible excavation of the resource, if warranted. Depending on the significance of
11 the find, it could also result in some modification to the project footprint. Since the SEZ is
12 located in an area classified as PFYC Class 3b, a stipulation would be included in permitting
13 documents to alert solar energy developers of the possibility of a delay if paleontological
14 resources are uncovered during surface-disturbing activities.

15 16 **8.3.16.3 SEZ-Specific Design Features and Design Feature Effectiveness**

17
18
19 Impacts would be minimized through the implementation of required programmatic
20 design features, including a stop-work stipulation in the event that paleontological resources are
21 encountered during construction, as described in Appendix A, Section A.2.2.

22
23 The need for and the nature of any SEZ-specific design features would depend on the
24 findings of the paleontological surveys. Mitigation is not likely to be needed in the PFYC Class 1
25 volcanic areas located within a portion of the access road corridor.
26

1 **8.3.17 Cultural Resources**

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4 **8.3.17.1 Affected Environment**

5
6
7 **8.3.17.1.1 Prehistory**

8
9 The proposed Gillespie SEZ is located in the northern Sonoran Desert, within the basin
10 and range province in western Arizona. The earliest known use of the area was likely during
11 the Paleoindian Period, sometime between 12,000 and 10,000 B.P. Surface finds of isolated
12 Paleoindian projectile points, the hallmark of the Clovis culture, have been discovered in the
13 Painted Rocks area, 14 mi (23 km) southwest of the proposed Gillespie SEZ; south of the SEZ
14 in the interior desert south of Gila Bend on the Barry M. Goldwater Range; and at Ventana Cave,
15 about 74 mi (119 km) southeast of the SEZ. The southeastern portion of Arizona has the one of
16 the highest concentrations of Paleoindian cultural material in North America, but the area around
17 the proposed Gillespie SEZ likely was not as conducive to Late Pleistocene occupation as other
18 areas. The majority of Paleoindian sites occur in the transition zone between mountain and desert
19 environments, and most of the sites that have been found in the desert are located close enough
20 to the transition zone to assume that they were likely located there during Paleoindian times. In
21 addition to projectile points, the Clovis culture is characterized by a hunting and gathering
22 subsistence economy, following migrating herds of Pleistocene megafauna. Paleoindian sites are
23 typically characterized by either fluted or unfluted projectile points, extinct mega fauna, chipped
24 stone tools, and bone and horn implements. Sites related to Paleoindian occupation are usually
25 either kill sites, where large numbers of animals were slaughtered, or sites that are thought to be
26 base camps. Tools were fashioned from either chert or obsidian; sources of obsidian are located
27 in the Sand Tank Mountains 34 mi (54 km) southeast, the South Saucedo Mountains 37 mi
28 (60 km) south, and the Vulture Mountains 42 mi (67 km) north of the SEZ (BLM 2010b;
29 Martin and Plog 1973; NROSL 2009; Reid and Whittlesey 1997).

30
31 The Archaic Period began at the end of the Pleistocene, about 10,000 to 8,000 B.P., and
32 continued until the advent of ceramics, about 2,000 B.P. Also referred to as the Cochise Culture,
33 the Archaic lifeways were similar to those of their Paleoindian predecessors, hunting and
34 gathering wild animals and plants, yet plants took on a greater role because there were no longer
35 the megafauna on which to subsist, and smaller animals such as deer, antelope, and rabbits were
36 hunted. Consequently, plant grinding tools, such as manos and metates, are more prevalent in the
37 archaeological record. Archaic people likely followed a seasonal round of movement, harvesting
38 and hunting what was available at that place and time; therefore these ephemeral sites are
39 difficult to distinguish. Within 5 mi (8 km) of the proposed Gillespie SEZ, an Archaic Period
40 lithic scatter and fire cracked rock (AZ T:9:27 [ASM]) was found. In addition, Archaic Period
41 sites have been discovered in the Harquahala Mountains, 43 mi (69 km) north of the SEZ, in the
42 Centennial Wash area on the Harquahala Plain, 15 mi (24 km) northwest of the SEZ, as well as
43 at Ventana Cave. Because Archaic Period people were so mobile, they maintained light and
44 portable equipment; baskets, milling stones, and spear points are the hallmarks of the Archaic
45 culture. It is assumed that Archaic Period groups would have lived and traveled with groups
46 of related families when local resources were abundant, but during hard times groups likely

1 dispersed, separated from other families or bands by environmental features such as deserts or
2 mountain ranges. It is possible that groups may have isolated themselves in resource-rich regions
3 for sustained periods of time, resulting in vast tracts of land that would have been unpopulated
4 for long spans of time. Other artifacts associated with southern Arizonan Archaic Period
5 lifeways are sleeping circles or camp clearings, trails, shrines, rock alignments, petroglyphs,
6 and zoomorphic intaglios. Three petroglyph sites (AZ T:13:32[ASM], AZ T:13:17[ASM], and
7 AZ T:13:120[ASM]) have been documented east of the SEZ, one of which, AZ T:13:120[ASM],
8 is made up of more than 100 glyphs (Reid and Whittlesey 1997).
9

10 The Late Archaic Period saw the beginnings of agriculture in Arizona. The Sonoran
11 Desert is believed to have been the heartland from which corn agriculture spread to the rest of
12 Arizona. In the middle of the twentieth century it was proposed that corn agriculture spread to
13 Arizona, from Mexico via the Sierra Madre corridor, to the Mogollon highlands, into the
14 Colorado Plateau, and then into the Sonoran Desert, prior to being adopted by the rest of the
15 region. More recent research has suggested the opposite, that the Sonoran Desert's warm
16 growing conditions and the planting of corn at low elevations using well-watered floodplains
17 was more conducive to corn agriculture and the technology spread widely from the Sonoran
18 Desert into the rest of Arizona. While these Late Archaic farmers were growing corn, it was not
19 their only means of subsistence, and therefore they continued to maintain a seasonal round of
20 hunting and gathering, while retaining a residence for a period of time near their fields to plant
21 and harvest their crops. Their base camps were located in lowlands, likely occupied in the
22 summer; these clusters of houses usually formed a generally circular arrangement with pits
23 located in the floors of houses or in areas between houses for the storage of tools and food. Often
24 the floors of houses were completely taken up by the storage pits and there were no hearths in the
25 houses, leading some archaeologists to believe that the primary function of the houses was for
26 storage and not habitation. Some Late Archaic sites have been found to have large, domed-
27 shaped structures, believed to be ceremonial in nature. The artifacts found in these structures
28 were likely used in a religious context, for example, a baton made of phyllite, pigments,
29 figurines, bone tubes, and worked shell pieces. It is believed that these structures were the
30 predecessors to the subsurface kivas constructed by later southwestern groups. Late Archaic
31 groups were also known to have produced ceramics, although they were not fashioned into
32 containers but figurines and beads (Matson 1991; Reid and Whittlesey 1997).
33

34 With the end of the Archaic Period, two distinct groups occupied the area in the vicinity
35 of the proposed Gillespie SEZ. The Hohokam people were largely centered around the Gila
36 River and its tributaries, and the Patayan culture was focused on the Colorado River and its
37 tributaries. The proposed Gillespie SEZ is located on the far western portion of the known
38 Hohokam area, so both Patayan and Hohokam are discussed.
39

40 There are two branches of the Hohokam culture, the River Hohokam and the Desert
41 Hohokam, the tradition beginning around A.D. 300 and extending until A.D. 1450. The River
42 Hohokam lived in large villages, sometimes occupied for hundreds of years, and utilized the
43 river to irrigate their crops through the construction of canals. The ability to establish long-term
44 occupations because of the river as a reliable water source allowed extensive public architectural
45 projects to be undertaken and craft specialization to occur. At some River Hohokam sites,
46 platform mounds and ball courts have been excavated, site AZ T 9:1[ASM], was found to the

1 east of the SEZ within 5 mi (8 km), consisting of a ball court and ceramic sherd scatter. It has
2 been suggested that the construction of large-scale irrigation projects, platform mounds, and ball
3 courts is reflective of a complex social and political relationship among the Hohokam. The area
4 around the Gila Bend and the Painted Rocks Reservoir, just 12 mi (20 km) south of the SEZ, is
5 rich in Hohokam Period sites and artifacts. The Desert Hohokam relied on flood water and
6 rainwater for farming. They lived in the valleys and bajadas that were not near the river zones
7 and planted their fields on alluvial fans and at the mouth of washes. Because the Desert
8 Hohokam relied on more ephemeral sources of water, they did not develop the long-term
9 occupation of sites and social complexity that the River Hohokam were able to. Both the River
10 and Desert Hohokam groups supplemented their diet through the collection of wild plants and
11 hunting, helping to provide some subsistence reliability during difficult agricultural times.
12 During the course of the Hohokam culture, settlements became more and more densely
13 populated, with material culture shifting and ceremonial and agricultural practices changing.
14 The archaeological assemblage associated with the Hohokam cultural tradition consists of
15 ceramics (vessels and figurines); bedrock mortars; carved, ground, and flaked stone artifacts;
16 shell jewelry; and stone bowls with effigies. In addition to the previously mentioned site, four
17 Hohokam Period sites have been found within 5 mi (8 km) of the SEZ, all east of the SEZ
18 toward the Gila River. Site AZ T:13:14[ASM] is a Hohokam Period ceramic sherd scatter, as
19 is site AZ T:9:2[ASM]. A ceramic sherd and lithic scatter, AZ T:13:21[ASM], also consisting
20 of historic trash, with about 11,500 total artifacts, is a site eligible for inclusion on the NRHP.
21 Another multicomponent site, AZ T:13:18[ASM], is a Hohokam and Patayan village with
22 burials and both a historic and prehistoric canal. Evidence of Hohokam occupation in the
23 archaeological record becomes very sparse during the late fourteenth and fifteenth centuries,
24 suggesting that either the culture changed its lifeways significantly enough to affect
25 interpretation of cultural materials related to the Hohokam or the Hohokam left the area, possibly
26 due to excessive flooding, oversalinization of agricultural fields, or conflicts with competing
27 groups (BLM 2010b; McGuire and Schiffer 1982; Neusius and Gross 2007; Reid and
28 Whittlesey 1997).

29
30 The Patayan culture occupied different regions of the Colorado River Valley; some
31 groups were concentrated in the upland environments, others in the lowlands. Similar to the
32 Desert Hohokam, the Patayan culture used floodwater to irrigate their crops, with the first
33 evidence of the Patayan culture seen about A.D. 700. Most Patayan sites were not permanent,
34 generally indicating temporary habitation or activity camps, although a few large Patayan sites
35 have been located on the southwestern portion of the Gila River representing longer term village
36 settlements. It is believed that the Patayan and Hohokam maintained a friendly relationship,
37 with interaction between the groups increasing through time. The Patayan moved seasonally,
38 occupying the river valleys in the summer, maintaining their horticultural endeavors, and moving
39 to the uplands to exploit piñon nuts and other upland resources. Trade was important for the
40 Patayan people; they created a vast network of trails, used not only for trade but also for travel
41 and connecting ceremonial territories. Along the trails, cairns and shrines can be found, as well
42 as campsites, intaglios, cleared circles, and petroglyphs. It is believed that the Patayan culture
43 was the antecedent culture to some of the contemporary Native American groups that were in
44 the area—the Maricopa, Mohave, Quechan, and Yavapai, but some suggest Hohokam derivation
45 instead. Pima groups are thought to have been descended from the Hohokam culture
46 (BLM 2010b; McGuire and Schiffer 1982; Neusius and Gross 2007; Reid and Whittlesey 1997).
47

1 **8.3.17.1.2 Ethnohistory**
2

3 The proposed Gillespie SEZ is situated in the traditional tribal use area of a community
4 of Yuman-speaking groups that came to be known as the Maricopa. They ranged along the Salt
5 and Gila River system from the Superstition Mountains in the east to the Mohawk Mountains in
6 the west. To the east they were interspersed with their allies, the Akimel O’odham or Pima
7 (Harwell and Kelly 1983).
8
9

10 **Maricopa**
11

12 The term “Maricopa” is an English abbreviation of the Spanish term “Cocomaricopa,”
13 applied to Yuman speakers occupying an area stretching from the lower Gila River east of the
14 Quechan to the Colorado River south of the Mohave, sometimes referred to as the Panya
15 (Bean et al. 1978). Probable descendants of the prehistoric Patayan culture, they seem to have
16 arrived along the Gila River near Gila Bend during the thirteenth century (Harwell and
17 Kelly 1983). The Panya group living along the Colorado River was also known as the
18 Halchidhoma. As with their Yuman neighbors, the Panya appear to have lived in dispersed
19 settlements near areas suitable for floodplain agriculture. From these settlements they dispersed
20 to hunt and gather upland resources in a seasonal round. Part of a trading network that stretched
21 as far as the Pacific Ocean, they were allied with the Cahuilla on the west and the Pima on the
22 east. Until the early nineteenth century they remained beyond the direct control of Spanish
23 authorities, but retained sufficient contact to selectively adopt elements of Euro-American
24 culture, among the most important of which was winter wheat, which allowed them to raise both
25 summer (maize) and winter crops. Also important were horses, for which they traded captives as
26 slaves (Bean et al. 1978).
27

28 In 1827, the Panya living along the Colorado and the neighboring Kahwan came under
29 attack by an alliance among the Mohave, Quechan, and Yavapai. The Kahwan were taken
30 captive and the Halchidhoma Panya were driven from their valley and upland ranges. They
31 initially took refuge in Sonora, but later established themselves on the middle Gila River, where
32 they were eventually joined by the Kahwan and the remnants of other Yuman-speaking groups,
33 the Kavelchadom and Halyikwamai (Bean et al. 1978; Harwell and Kelly 1983). Partly as a
34 defense against raiding Apache, this Maricopa amalgam allied itself with the neighboring Pima,
35 who practiced irrigation agriculture. Beginning in the late 1840s, the Maricopa and Pima were
36 producing crops they could sell to Americans beginning to pass through to California—first
37 contingents of the U.S. Army and then Euro-American forty-niners. Maricopa and Pima
38 agriculture continued to supply travelers. Congress granted them a reservation in the middle
39 Gila Valley in 1859. However, after the Civil War, gold was discovered in western Arizona.
40 American farmers began to arrive, settling upstream and diverting the water used by the Pima
41 and Maricopa. With reduced agricultural production, the Maricopa and Pima relied more on the
42 gathering of wild foods, and many moved to the Salt River Valley, where a second reservation
43 had been established by 1879. With the coming of the railroad in 1877, there was no longer a
44 market for supplying travelers on the road west. However, the trains brought tourists, who
45 purchased intricate baskets and pottery produced by Maricopa women. Men became involved in
46 the new economy as wage laborers. After the passage of the Indian Reorganization Act of 1934,

1 the Gila River and Salt River reservations organized under its provisions (Bean et al. 1978;
2 Harwell and Kelly 1983). While few Maricopa now farm, recently the Maricopa and Pima have
3 actively sought to regain their water rights in the hopes of restoring an agricultural base to their
4 communities (Lewis and Hestand 2006).

5
6 In the summer, the Maricopa took shelter in open-sided ramadas. For winter use they
7 built flattened dome-shaped, earth-covered structures built on a rectangular four-post frame tied
8 together by mesquite or ironwood beams, similar to the winter houses of the Quechan. As with
9 other mobile groups in the Southwest, they were expert basket makers but were well-versed in
10 the making of pottery by the paddle and anvil method. Using small looms, they wove cloth
11 bands. Stone manos and metates along with wooden mortars were used to process plant material.
12 Other traditional material culture included stone knives and stone tipped arrows, along with
13 netting used in rabbit drives (Spier 1970). Maricopa descendants can be found on the Gila Bend
14 and Salt River Pima–Maricopa Reservations.

15 16 **Akimel O’odham (Pima)**

17
18
19 The Native Americans commonly referred to as Pima call themselves Akimel O’odham,
20 “the river people,” to distinguish themselves from the Tohono O’odham or “desert people,”
21 commonly known as Papago. Linguists describe their language as belonging to the Piman branch
22 of the Uto-Aztecan family. Traditionally they lived along the Gila and Salt Rivers and their
23 tributaries from west of the Salt–Gila confluence to as far east as the San Pedro River. Located in
24 the core area of the prehistoric Hohokam culture, they are very likely descended from it. Like the
25 Hohokam, their subsistence base included irrigation agriculture supplemented by hunting and
26 gathering (Ezell 1983; Fontana 1983a).

27
28 Regular contact with the Spanish, beginning in 1690, resulted in important changes for
29 the Akimel O’odham. Prior to Mexican independence in 1821, there was little or no direct
30 Hispanic colonization of the Salt–Gila valley. Rather, the Pima were treated as important trading
31 partners. The Spanish introduced wheat, which the Pima could plant in the winter to supplement
32 their traditional summer crops of maize, beans, and squash. Surplus yield was traded with the
33 Spanish. The Pima were drawn into a market economy, and their population appears to have
34 increased (Ezell 1983; Hackenberg 1983). Cultural exchange with the Spanish continued, and
35 the Akimel O’odham adopted some aspects of Christianity.

36
37 Traditionally, the Akimel O’odham dwelt in circular brush dwellings with earthen roofs
38 supported by mesquite or ironwood posts with mesquite or saguaro cross ties. These dwellings
39 were grouped into household compounds. Settlements included compounds, public buildings,
40 and ceremonial space often surrounded by agricultural fields. Traditional artifacts include a
41 variety of basketry used for carrying and storing food as well as winnowing. Stone manos and
42 metates and wooden mortars were used to process grains and mesquite. The Pima were
43 competent potters (Bahr 1983; Ezell 1983; Fontana 1983a).

44
45 Already tied to the Maricopa by trade ties and military alliance, the Akimel O’odham
46 received Maricopa refugees driven from the Colorado River Valley by the Quechan and

1 Mohave in 1827. The Maricopa and other Yuman speakers mainly settled downstream along
2 the Gila, but interaction and intermarriage resulted in shared occupation of the area. By 1846,
3 the U.S. military appeared in the area followed by Americans and Mexicans heading for the gold
4 fields of California. Already accustomed to engaging in agricultural production for the market,
5 the Pima and Maricopa profited by selling food to those traveling through the area. Initially, the
6 Pima and Maricopa aided the U.S. Cavalry against their common enemy, the Apache. The
7 discovery of mineral wealth in western Arizona in the 1860s brought an influx of permanent
8 American settlers, among whom were ranchers and farmers who sought the same limited water
9 supply used by the Pima. They obtained it by diverting water upstream from the Native
10 American irrigation systems, forcing an increased reliance on wild foods and a change from
11 independent farmers to wage laborers. Even with the establishment of reservations beginning in
12 1879, water continued to be diverted from Piman fields. After reorganization under the Indian
13 Reorganization Act of 1934 and the return of those who served in the military in World War II,
14 the Akimel O’odham became more assertive in developing their resources, including reclaiming
15 their water rights (DeJong 2004, 2007; Ezell 1983). Akimel O’odham descendants can be found
16 on the Gila River, Salt River, and Ak Chin reservations, as well as in the surrounding
17 communities (Fontana 1983a).

20 **Tohono O’odham (Papago)**

21
22 The Tohono O’odham are the southern neighbors of the Akimel O’odham, both of which
23 are Upper Piman Tribes speaking dialects of the same language. Their traditional use area was
24 away from permanent streams but in the Arizona Upland vegetation zone of the Sonoran Desert,
25 which receives somewhat more rainfall than the desert lands to the west. They were transhumant,
26 spending winters in mountain foothills near permanent springs and summers in intermontane
27 plains, where they depended on summer rains to farm the mouths of mountain washes. Typically,
28 their dwellings were made of brush (Fontana 1983b).

29
30 Spanish contact with Upper Pimans was initiated by the Jesuits in 1687, introducing
31 wheat, horses, and cattle. Friars were able to recruit natives for their missions, where they
32 encountered European culture, Christianity, and diseases. Discovery of silver in 1736 near the
33 current international border attracted Spanish prospectors followed by military and civilian
34 farmers and ranchers. The Upper Pimans allied with the Spanish against their common enemy,
35 the Apache; however, Spanish settlers never penetrated the Tohono O’odham heartland. In 1821,
36 Mexico gained independence from Spain, and there was an increase of Mexican immigration. At
37 about the same time, trappers from Canada and the United States penetrated as far as the Gila
38 River in search of beaver pelts. The Treaty of Hidalgo, ending the Mexican War, left the Tohono
39 O’odham in Mexico. However, the Gadsen Purchase moved the border southward, dividing the
40 Tohono O’odham Nation. Initially, the international boundary had no meaning for the Tohono
41 O’odham, who continued to travel throughout their traditional territory. However, by the 1890s
42 most had migrated north of the border. Tohono O’odham interaction with the newly arriving
43 Americans was similar to that of the Akimel O’odham, with some Tohono O’odham adapting to
44 the new economy as wage laborers. Reservations were set aside for the Tohono O’odham at
45 Mission San Xavier near Tucson in 1874 and at Gila Bend in 1882. The latter proved to be
46 something of a northern outlier. A much larger reservation was created within their traditional

1 use area in 1916 extending from the Mexican border into Pinal and Maricopa Counties. In 1937,
2 the Tribe organized under the Indian Reorganization Act of 1934. Except for San Xavier lands
3 allotted to individuals under the Dawes Act of 1887, reservation lands belong to the Tribe.
4 Successful enterprises on the reservation include cattle ranching, mining leases, and gaming
5 (Fontana 1983b). The Gila Bend Reservation included a successful 750-acre farm until it was
6 inundated by the construction of the Painted Rock Dam.
7
8

9 **8.3.17.1.3 History**

10
11 After Christopher Columbus landed in the Caribbean in 1492, Spanish exploration of
12 the Americas quickly ensued, with Spain claiming vast tracts of land in the New World in the
13 name of King Ferdinand and Queen Isabella. There is some debate as to which of the Spanish
14 explorers made the first entry into Arizona. Some historians believe it was Alvar Nunez Cabeza
15 de Vaca, a Spaniard who shipwrecked off the coast of Texas in 1528 and developed friendly
16 relations with the Native Americans, who then helped to guide him to Mexico City. It has been
17 suggested that Cabeza de Vaca may have passed through the southeastern corner of Arizona on
18 his travels, but because he did not have any way of recording where he was, his exact route is
19 unknown. Cabeza de Vaca is important to the history of Arizona, not only because he may have
20 been the first European presence in the state but also because he claimed to have been told and
21 seen some of the “Seven Cities of Cibola,” fictitious cities full of gold and wealth, ripe for
22 Spanish plundering. When Cabeza de Vaca eventually got to Mexico City in 1536, he spread
23 the rumors of these fabled cities, which led to the desire of other Spaniards to search for riches
24 in the hope of finding another civilization rich in gold similar to the Aztec in Mexico. The first
25 documented expedition into what is today Arizona was headed by Fray Marcos de Niza, in 1539.
26 Fray Marcos wanted to assure the Native Americans who he encountered on his expedition that
27 they would be treated well, as news of the poor treatment of Native Americans by European
28 explorers had preceded the actual presence of the explorers. Accompanying Fray Marcos was
29 an African slave, Estebanico, who had survived the journey along with Cabeza de Vaca, and
30 Francisco Vazquez de Coronado, the governor of a northern Mexican province. After stopping in
31 Mexico at Vacapa, Fray Marcos sent Estebanico ahead with orders to scout the area and wait for
32 the rest of the explorers. Estebanico did not follow Fray Marcos’ orders and entered Arizona,
33 where he may have reached the Piman villages near Tucson, before heading farther north to the
34 Zuni pueblo, Cibola. Estebanico was killed by the Zuni, and Fray Marcos followed his trail
35 north, claiming all the land along the way in the name of New Spain. He claimed to have made
36 his way to Cibola and, after returning to Mexico City, also claimed to have seen vast riches at
37 the city. In 1540 Francisco Vazquez de Coronado led an expedition to officially lay claim to
38 these rumored cities of gold and led his expedition into eastern Arizona, following the Sonora
39 and San Pedro Rivers and then into New Mexico, and may have made his way as far as Kansas
40 before heading back to Mexico City empty-handed. Also funded by the Coronado expedition
41 was Hernando de Alarcon, who sailed up the Gulf of California and explored the Colorado delta
42 area, perhaps going as far north as the Gila and Colorado confluence. When Coronado came
43 back without any gold or any prospects for further exploration, the Spanish stayed out of most
44 of the hostile desert southwest for the next 40 years (BLM 2010b; Farish 1915; Kessell 2002;
45 Sheridan 1995).
46

1 Antonia de Espejo explored portions of northern and central Arizona in 1583 in an effort
2 to find precious metals. Espejo traded with the Hopi and discovered silver and copper deposits
3 east of Prescott, Arizona, about 85 mi (137 km) north of the proposed Gillespie SEZ. In 1604
4 Juan de Onate, a Mexican-born Spaniard who had settled in northern New Mexico, explored
5 portions of Arizona north of the SEZ along the Bill Williams Fork, to its confluence with the
6 Colorado River, and followed the Colorado River south to the Gulf of California, likely coming
7 within 95 mi (153 km) west of the proposed Gillespie SEZ.
8

9 The Spanish did not maintain an established presence in Arizona, other than a few short-
10 lived missions in the south central portion of the state, until the 1736 discovery of large silver
11 deposits near Nogales, 177 mi (285 km) southeast of the proposed Gillespie SEZ. Most of the
12 prospectors who came to mine the silver and stayed in Arizona were forced to make their
13 living as subsistence farmers and ranchers, because mining did not prove lucrative for another
14 100 years. The first permanent Spanish settlement in Arizona was at Tubac, just north of
15 Nogales, in an effort to prevent uprisings of the O’odham Tribe. The Spanish attempted to
16 build permanent settlements along the Lower Colorado River, but hostile Yuman Tribes
17 prevented any sustained development. With Apache hostility in the northern and eastern
18 portions of the state, Spanish settlement was basically restricted to the Tucson area and south
19 (Kessell 2002; Sheridan 1995).
20

21 Missionary explorer Eusebio Francisco Kino made nine different expeditions into the
22 territories of California and Arizona, establishing relationships with the Yuman and Piman
23 groups in the area. Kino was one of the first Europeans to explore the area around the proposed
24 Gillespie SEZ, as he was known to have explored the Gila Bend area in 1699. In 1775 Juan
25 Batista de Anza was authorized by the viceroy of New Spain to lead a group of settlers from
26 Tubac to the San Francisco Bay area. De Anza set out along the Santa Cruz River, which he
27 followed to the Gila River, then to the confluence with the Colorado River, and into California.
28 This expedition established a trail that eventually became a congressionally designated National
29 Historic Trail, passing just 17 mi (27 km) south of the proposed Gillespie SEZ (Kessell 2002).
30

31 In 1810 Mexicans declared their independence from Spanish colonial rule and in 1821
32 won the war. Mexican authority and control in Arizona was disjointed, and often states would
33 act independently from the rest of the country. Increasingly tense relations between Native
34 Americans and the non-Native occupiers were intensified with the expansion of ranchers and
35 homesteaders into Native American areas, leading to several conflicts. The Mexican-American
36 War began in 1846 with the United States eyeing the Rio Grande River and California Territory,
37 and two years later the Treaty of Guadalupe was signed, giving the United States control of
38 Texas, New Mexico (which included Arizona north of the Gila River), and California. When the
39 Gadsden Purchase was made in 1854, the United States gained control of Arizona south of the
40 Gila River and the Mesilla Valley of New Mexico, and settlement of the area increased to
41 previously unseen levels (Kessell 2002; Sheridan 1995).
42

43 Prior to the Mexican-American War, Americans had ventured into Arizona on fur-
44 trapping expeditions. The first known American fur-trappers in Arizona were Sylvester Pattie
45 and his son James in 1825, trapping along the San Francisco, Gila, and San Pedro Rivers in the
46 southeastern portion of Arizona. Frequently hostilities broke out between Native Americans and

1 fur trappers, but the trappers did not remain in the state long enough to make much of an
2 economic or ecological impact. One of the first and largest U.S. expeditions to cross Arizona at
3 the time was made by the Mormon Battalion in 1846. Led by Lieutenant Colonel Phillip St.
4 George Cooke, the group intended to establish a wagon trail across the southern Great Plains and
5 the Southwest. The Mormon Battalion was the first representative of the U.S. Government to
6 encounter the Mexican population, a nonconfrontational meeting. The trail that the Mormon
7 Battalion took later became a part of the Gila Route, or Southern Overland Route, a network of
8 Native American and European trails that entered the state in the east, converged on the Pima
9 villages on the Gila River, and traversed the Gila River floodplain to the Colorado and Gila
10 River confluence, likely passing just 17 mi (27 km) south of the SEZ (Sheridan 1995).

11
12 Most occupation of Arizona after the acquisition of the territory by the U.S. Government
13 was concentrated in the southern part of the state in mining ventures. It was not until the
14 establishment of Fort Yuma on the California side of the Colorado River, and other nearby
15 military garrisons, when Americans began to settle in the region near the proposed Gillespie
16 SEZ. The forts provided the necessary security against Native Americans who resented the
17 American occupation of their land and who were competing for the same resources as the miners
18 and ranchers settling in the desert. After the start of the Civil War, most of the military personnel
19 in Arizona were withdrawn, leaving the settlers to their own defenses until the end of the war
20 (Sheridan 1995; Stone 1982).

21
22 In 1857, 20 mi (32 km) up the Gila River from the Colorado junction, Arizona's first
23 boomtown, Gila City, was established after a gold strike. The largest and most prosperous gold
24 mine in Arizona occurred at Vulture Mine, near Wickenburg, about 40 mi (64 km) north of the
25 proposed Gillespie SEZ. The creation of canals, roads, and other infrastructure helped to increase
26 the population of Arizona and their ability to grow crops, export and import goods, and maintain
27 the mines. The Phoenix Stage Route was established as part of this infrastructure, leading to
28 Wickenburg becoming a transportation hub and the headquarters of the Arizona-California
29 Stage Company. During the 1870s copper, silver, gold, and other less valuable minerals were
30 mined fervently throughout the state, and with the construction of railroads in 1881 and 1882,
31 mining only increased. The Southern Pacific Railroad was an important rail line that connected
32 Los Angeles, California, to Deming, New Mexico. A spur connected to this line passes less
33 than 1 mi (1.6 km) north of the SEZ, designated as site AZ T:10:84[ASM]. Construction of
34 the railroad was completed in 1881, and it was the second transcontinental railroad in the
35 United States. Associated with the railroad is the Crag Railroad Station, site AZ T:9:25[ASM],
36 located within 5 mi (8 km) of the proposed Gillespie SEZ (Stone 1982; Sheridan 1995).

37
38 Settlement, ranching, and mining in Arizona are dependent upon water regulation and
39 dispersal, and consequently water control projects were started early in the development of
40 Arizona. Often prehistoric canals were used and/or expanded in order to facilitate water usage.
41 Just as in prehistoric times, people would generally settle only in places where water was
42 available. Numerous canals were constructed using the water from the Gila River, and in the
43 vicinity of the proposed Gillespie SEZ are the historic Enterprise Canal, the Arlington Canal,
44 the Gila Bend Canal, and the Buckeye Canal.

1 The U.S. military has a long relationship with the southwestern desert. The vast,
2 uninhabited lands make it prime real estate for training exercises. Large amounts of the desert
3 west of the proposed Gillespie SEZ were used for training troops for the North African invasion
4 in World War II, with bases and air fields placed throughout the desert. Most of those bases are
5 not very close to the proposed SEZ, except for Luke Air Force Base, southeast of the SEZ. Luke
6 Air Force Base was established for training pilots during World War II and continues to operate
7 as a training facility for the U.S. Air Force. Under the control of the Luke Air Force Base are the
8 Barry M. Goldwater Range and the Gila Bend Auxiliary Air Field, just 23 mi (37 km) south of
9 the SEZ, and the proposed Gillespie SEZ is in the Airspace Consultation Area of the DoD. The
10 YPG was established in 1963, covering 990,000 acres (4,006 km²) north of the Gila River, the
11 closest portion to the proposed Gillespie SEZ being about 43 mi (69 km) west. While the YPG
12 was not established until the mid-twentieth century, the presence of the U.S. Army in the Yuma
13 area has been felt since the construction of the first fort there in 1850 and subsequent periodic
14 occupation of the area by the military. The YPG consists of the Yuma Test Center, the Tropic
15 Regions Test Center, and the Cold Regions Test Center, each center specializing in a specific
16 type of military testing. The purpose of the YPG is as a test facility for all branches of the
17 military, from artillery and bomb testing to automotive and helicopter tests (Stone 1982, 1986;
18 Wullenjohn 2010).

21 **8.3.17.1.4 Traditional Cultural Properties—Landscape**

23 According to Maricopa beliefs, certain features of the landscape house beings or spirits
24 of power; all are culturally important. Some of these are places where dreams of power may be
25 sought. In traditional Maricopa culture, power and success are achieved through dreaming.
26 Others define cultural boundaries and have protective powers. Caves of power are reported from
27 the Painted Rocks Mountains, 16 mi (26 km) south of the SEZ on the other side of the Gila Bend
28 Mountains, to “Bat’s House,” a butte south of Tempe. Other mountains have protective spirits
29 that define the Maricopa homeland and may fight the spirits of the mountains in enemy lands.
30 These include Sierra Estrella, 38 mi (61 km) east of the SEZ, and Pima Butte, 46 mi (75 km)
31 southeast. Other peaks of power include the Salt River Range, 40 mi (64 km) east; “Water
32 Divider,” 31 mi (50 km) east; an outlier of the Sierra Estrella Range, just west of the Gila–
33 Salt confluence; and the Mohawk Mountains, 61 mi (99 km) southwest along the Gila River
34 (Spier 1970). None of these mountains is close to the proposed SEZ, and those to the east are at
35 least partially obscured by intervening mountains. Closer to the proposed SEZ, the Gila Bend
36 Mountains have been identified as a source of traditional plant resources, known rock art panels,
37 sacred areas, and burials (Bean et al. 1978). While the reservation closest to the proposed SEZ
38 is the San Lucy District of the Tohono O’odham (Gila Bend Indian Reservation), the center of
39 the Tohono O’odham universe, Baboquivari Mountain, is located far to the south, about 50 mi
40 (80 km) west of Tucson (Joseph 1949).

42 Places sacred to the Pima include locations in the San Tan Hills and near Gila Crossing
43 (Russell 1975). These are well east of the SEZ (65 mi [105 km] and 38 mi [61 km], respectively)
44 behind intervening mountains and would not be visible. In the past, the Akimel O’odham and
45 Tohono O’odham have continued to revere Hohokam sacred places (Russell 1975). Site

1 AZ T9:1[ASM], a Hohokam platform mound and ball court located less than 5 mi (8 km)
2 from the SEZ, is likely to be of importance to the Pima and Papago.

3 4 5 **8.3.17.1.5 Cultural Surveys and Known Archaeological and Historical Resources** 6

7 In the proposed Gillespie SEZ, five cultural resource surveys, four linear surveys, and
8 one block survey have been conducted, covering a very small percentage of the SEZ. These
9 surveys have not recorded any resources within the boundaries of the SEZ; however, 59 surveys
10 that have been conducted within 5 mi (8 km) of the proposed Gillespie SEZ have recorded
11 30 sites. Of these 30 sites, 14 are prehistoric, 11 are historic, and 5 are multicomponent sites,
12 consisting of both prehistoric and historic resources. Two of the prehistoric sites within 5 mi
13 (8 km) have been determined eligible for inclusion on the NRHP, one site (AZ T:13:121[ASM])
14 is a petroglyph site southeast of the SEZ, and the other (AZ T:9:1[ASU]) is a ceramic sherd and
15 lithic scatter northeast of the SEZ. Several other sites with significant prehistoric cultural
16 resources have not been evaluated for NRHP eligibility, but, if assessed, could be added to the
17 list of NRHP-eligible properties. Three of the multicomponent sites are eligible for listing on
18 the NRHP. Site AZ Z:2:66[ASM] is the Gila Bend Canal, both a historic and prehistoric
19 canal. Another site, AZ T:13:18[ASM], is a historic canal and Hohokam and Patayan village
20 considered eligible for inclusion on the NRHP. A site consisting of 11,500 prehistoric and
21 historic artifacts, AZ T:13:21[ASM], is also an NRHP-eligible site. Five NRHP-eligible historic
22 period properties are within 5 mi (8 km) of the proposed Gillespie SEZ. Site AZ T:10:84[ASM]
23 is the Southern Pacific Railroad, just north of the SEZ, and site AZ T:9:25[ASM] is the Crag
24 Railroad Station, associated with the rail line. The Arlington Canal, AZ T:10:80[ASM],
25 northeast of the SEZ, is eligible for inclusion on the NRHP. Arlington Elementary School,
26 AZ T:9:88[ASM], is a historic school that is still currently used by the local school district. East
27 of the proposed Gillespie SEZ is Old Highway State Route 80, originally constructed in 1932
28 and eligible for inclusion on the NRHP.

29
30 The BLM has designated several ACECs and SCRMA in the vicinity of the proposed
31 Gillespie SEZ, because these areas have been determined to be rich in cultural resources and
32 worthy of having the resources managed and protected by the BLM. The closest designated area
33 to the proposed Gillespie SEZ is the Sears Point ACEC, 27 mi (43 km) southwest of the SEZ.
34 The Harquahala ACEC is 37 mi (60 km) northwest of the SEZ, and contained almost entirely
35 within the ACEC is the Harquahala SCRMA. These ACECs and SCRMA are designated to
36 protect the Harquahala Peak Observatory and Historic District (which is listed on the NRHP),
37 Ellison's Camp and historic trails, as well as several prehistoric habitation camps, milling areas,
38 and rock art sites. The Black Butte ACEC is 35 mi (56 km) north of the SEZ and is designated
39 to protect an obsidian source used by the Native Americans prehistorically and the ecological
40 resources there. The Wickenburg/Vulture SCRMA is 45 mi (72 km) north of the proposed
41 Gillespie SEZ; this SCRMA was designated to protect the historic sites and roads associated
42 with mining and settlement in the area, as well as a prehistoric obsidian source. Situated just
43 12 mi (19 km) southeast of the proposed Gillespie SEZ is the Sonoran Desert National
44 Monument, a 487,000-acre (1,971-km²) parcel of land that protects significant archaeological
45 and historical sites, historic trails, and several WAs. Fifty miles (80 km) east of the proposed
46 Gillespie SEZ is the Hohokam Pima National Monument, a congressionally designated area

1 that protects the archaeological sites affiliated with “Snaketown,” a significant Hohokam
2 settlement on the Gila River Indian Reservation (BLM 2007a, 2010c).

3 4 5 ***National Register of Historic Places*** 6

7 There are no properties in the SEZ listed in the NRHP, but one property is within 5 mi
8 (8 km) of the SEZ. The Gillespie Dam Highway Bridge, spanning the Gila River, was built in
9 1927 and is situated just 3 mi (5 km) southeast of the SEZ. There are 325 properties in Maricopa
10 County listed in the NRHP, 280 of which are located in the Phoenix metropolitan area, about
11 40 mi (64 km) east of the proposed Gillespie SEZ. The Wickenburg area, 49 mi (79 km) north
12 of the SEZ, maintains 23 NRHP properties. In the immediate vicinity of the proposed Gillespie
13 SEZ is the Hassayampa River Bridge, 9 mi (14 km) northeast of the SEZ. Painted Rocks is an
14 archaeological site with extensive petroglyphs and other prehistoric resources, 19 mi (30 km)
15 southwest of the proposed Gillespie SEZ. The Gila Bend Overpass, another NRHP-listed
16 property, is 21 mi (34 km) south of the SEZ. In the vicinity of Gila Bend are two archaeological
17 sites situated farther than 10 mi (16 km) south of the SEZ, the Gatlin Site and the Fortaleza Site.
18 The initial point of the Gila and Salt Rivers baseline and meridian, the point which governs
19 surveys in Arizona, is 34 mi (55 km) east of the SEZ. In Morristown, 43 mi (69 km) north of the
20 SEZ, is the Morristown Store. The other properties in Maricopa County listed on the NRHP are
21 far enough from the SEZ so as not to be affected by solar development (in excess of 60 mi
22 [97 km]): Carefree (Brazaletes Pueblo Site and Sears-Kay Ruin), Rio Verde Estates (Azatlan
23 Archaeological Site), Punkin Center (Sunflower Ranger Station), Cave Creek (Cave Creek
24 Service Station and Tubercular Cabin), New River (Sun-Up Ranch), and Fort McDowell, all
25 northeast of the SEZ; and Queen Creek (Rittenhouse Elementary School), Tortilla Flat (Boulder
26 Creek Bridge, Fish Creek Bridge, Lewis and Pranty Creek Bridge, Mormon Flat Bridge, and
27 Pine Creek Bridge), and Apache Junction (Skeleton Cave Massacre), all east of the SEZ.
28
29

30 **8.3.17.2 Impacts** 31

32 Direct impacts on significant cultural resources in the proposed Gillespie SEZ could
33 occur; however, further investigation is needed. A cultural resources survey of the entire APE of
34 a proposed project, including consultation with affected Native American Tribes, would first
35 need to be conducted to identify archaeological sites, historic structures and features, and
36 traditional cultural properties, and an evaluation would need to follow to determine whether any
37 are eligible for listing in the NRHP as historic properties. The proposed Gillespie SEZ has
38 potential for containing significant prehistoric sites, especially in the eastern portion, because it
39 is close to the Gila River. There is also potential for historic resources, especially in the area
40 north of the SEZ near the Southern Pacific Railroad and also in the area near the Gila River.
41 Section 5.15 discusses the types of effects that could occur on any significant cultural resources
42 found to be present within the proposed Gillespie SEZ. Impacts would be minimized through the
43 implementation of required programmatic design features described in Appendix A,
44 Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and
45 consultations will occur.
46

1 Programmatic design features to reduce water runoff and sedimentation would prevent
2 the likelihood of indirect impacts on cultural resources resulting from erosion outside the SEZ
3 boundary (including along ROWs).
4

5 The nearest road to the SEZ is Old Highway 80, about 3 mi (5 km) east of the proposed
6 Gillespie SEZ. Construction of an access road intersecting Old Highway 80 would result in the
7 disturbance of 22 acres (0.09 km²). Old Highway 80 is a property eligible for inclusion on the
8 NRHP; a final determination of this property's eligibility status would need to be made prior to
9 modification of the road. Indirect impacts, such as vandalism or theft, could occur if significant
10 resources are close to the ROW. Programmatic design features assume that the necessary
11 surveys, evaluations, and consultations for the ROW will occur, as with the project footprint
12 within the SEZ. No needs for new transmission lines have currently been identified, assuming
13 the existing transmission system would be used; therefore, no additional areas of cultural concern
14 would be made accessible as a result of development within the proposed Gillespie SEZ.
15 However, impacts on cultural resources related to the creation of new corridors not assessed in
16 this PEIS would be evaluated at the project-specific level if new road or transmission
17 construction or line upgrades are to occur.
18
19

20 **8.3.17.3 SEZ-Specific Design Features and Design Feature Effectiveness**

21
22 Programmatic design features to mitigate adverse effects on significant cultural
23 resources, such as avoidance of significant sites and features and cultural awareness training for
24 the workforce, are provided in Appendix A, Section A.2.2.
25

26 SEZ-specific design features would be determined in consultation with the Arizona
27 SHPO and affected Tribes following the completion of cultural surveys.
28

29 Recordation of historic structures through Historic American Building Survey/Historic
30 American Engineering Record protocols through the NPS would also be appropriate and could
31 be required if any historic structures or features would be affected, for example, if the Gillespie
32 Dam Highway Bridge is to be used as an off-site access route for a solar energy project.
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1 **8.3.18 Native American Concerns**
2

3 As discussed in Section 8.3.17, Native Americans often view their environment
4 holistically and share many environmental and socioeconomic concerns with other ethnic groups.
5 For a discussion of issues of possible Native American concern shared with the population as a
6 whole, several sections in this PEIS should be consulted. General topics of concern are addressed
7 in Section 4.16. Issues of human health and safety are discussed in Section 5.21. Specifically
8 for the proposed Gillespie SEZ, Section 8.3.17 discusses archaeological sites, structures,
9 landscapes, and traditional cultural properties; Section 8.3.8 discusses mineral resources;
10 Section 8.3.9.1.3 discusses water rights and water use; Section 8.3.10 discusses plant species;
11 Section 8.3.11 discusses wildlife species, including wildlife migration patterns; Section 8.3.13
12 discusses air quality; Section 8.3.14 discusses visual resources; and Sections 8.3.19 and 8.3.20
13 discuss socioeconomics and environmental justice, respectively. This section focuses on
14 concerns that are specific to Native Americans and to which Native Americans bring a distinct
15 perspective.
16

17 All federally recognized Tribes with traditional ties to the proposed Gillespie SEZ have
18 been contacted so that they could identify their concerns regarding solar energy development.
19 The Tribes contacted with traditional ties to the Gillespie SEZ are listed in Table 8.3.18-1.
20 Appendix K lists all federally recognized Tribes contacted for this PEIS.
21

22 To date, no comments have been received from the Tribes specifically referencing the
23 proposed Gillespie SEZ. However, commenting on past transmission line projects in the area,
24 members of the Tohono O’odham Nation expressed concerns with the following resources, in
25 order of importance: game animals (deer, rabbits, peccary), viewshed, wild food plants (yucca,
26 cholla, saguaro, prickly pear, mesquite), rock art, medicinal plants, minerals (copper and clay),
27 sacred areas, and cremation and burial zones (Bean et al. 1978).
28
29

30 **8.3.18.1 Affected Environment**
31

32 Traditionally, the Gila River corridor was occupied by at least three Native American
33 ethnic groups: Maricopa, Akimel O’odham (Pima), and Tohono O’odham (Papago). Long-term
34 allies and in some cases linguistically related, the groups have experienced considerable mixing.
35
36

**TABLE 8.3.18-1 Federally Recognized Tribes with
Traditional Ties to the Proposed Gillespie SEZ**

Tribe	Location	State
Ak Chin Indian Community	Maricopa	Arizona
Gila River Indian Community	Sacaton	Arizona
Hopi Tribe	Kykotsmovi	Arizona
Salt River Pima-Maricopa Indian Community	Scottsdale	Arizona
Tohono O’odham Nation	Sells	Arizona

1 *The Handbook of North American Indians* (Ortiz 1983) does not draw a territorial dividing line
2 between the Akimel O’odham and the Tohono O’odham. It does distinguish a separate Maricopa
3 territory within the Gila Corridor from the Gila Bend downstream as far as the Mohawk
4 Mountains, yet a modern reservation associated with the Tohono O’odham lies within that
5 territory and Maricopa descendants are living in the Gila and Salt River reservations in what is
6 shown as Pima/Papago territory. The proposed Gillespie SEZ lies within the traditional range of
7 the Maricopa, as shown in the handbook. The Indian Claims Commission included the area in
8 the judicially established Pima-Maricopa traditional territory (Royster 2008).

9
10
11 **8.3.18.1.1 Traditional Tribal Use Areas**
12

13
14 **Maricopa**
15

16 Traditionally the Maricopa ranged along the Gila and Salt Rivers and their tributaries
17 from the Superstition Mountains in the east– northwest to just below New River, westward to
18 the Hassayampa Valley, and along the Gila River as far west as the Mohawk Mountains
19 (Harwell and Kelly 1983). The Indian Claims Commission included most of these lands in
20 judicially recognized territory of the Pima-Maricopa (Royster 2008). Today, elements of the
21 Maricopa are found at Lehi on the Salt River Reservation and Laveen near the confluence of the
22 Gila and Salt Rivers on the Gila River Reservation. Maricopa descendants also live in nearby
23 urban centers (Harwell and Kelly 1983).

24
25
26 **Akimel O’odham (Pima)**
27

28 Except for the western reach of the Gila River from just above its confluence with the
29 Hassayampa River to the Mohawk Mountains, traditionally Akimel O’odham or Pima villages
30 were scattered over the same territory as the Maricopa. This shared territory was recognized by
31 the Indian Claims Commission in judicially establishing a joint traditional territory. Akimel
32 O’odham can be found on the Ak Chin, Gila River, and Salt River reservations and in nearby
33 communities.

34
35
36 **Tohono O’odham (Papago)**
37

38 The Tohono O’odham traditionally lived in the deserts south of the Akimel O’odham and
39 Maricopa away from the rivers. They extended southwards into modern Sonora Mexico as far as
40 the Gulf of California (Fontana 1983a). The Indian Claims Commission recognized Papago
41 traditional territory as extending south from Pima-Maricopa and Western Apache lands to the
42 international border, and as far west as the eastern borders of the Lower Colorado Valley
43 (Royster 2008). Today, Tohono O’odham communities can be found on the Ak Chin and Tohono
44 O’odham reservations in Arizona and in urban communities in Arizona and California
45 (Fontana 1983b).

1 **8.3.18.1.2 Plant Resources**
2

3 This section focuses on those Native American concerns that have an ecological as
4 well as a cultural component. For many Native Americans, the taking of game or the gathering
5 of plants or other natural resources may have been seen as both a sacred and secular act
6 (Bean et al. 1978; Stoffle et al. 1990).
7

8 Traditionally, the Maricopa, Akimel O’odham, and Tohono O’odham all relied on a
9 diversified subsistence base, including farming, hunting, and gathering and, after the arrival of
10 the Spanish, raising livestock. The degree to which each group relied on each method varied.
11 The Maricopa and Akimel O’odham were more dependent on irrigation agriculture, while the
12 Tohono O’odham relied more heavily on hunting and gathering and for the most part practiced
13 rainfall agriculture in the uplands (Hackenberg 1983). The proposed Gillespie SEZ lies within
14 the traditional Maricopa range but is only 16 mi (26 km) from a Tohono O’odham reservation
15 (San Lucy Village). The reservation is only 3 mi (5 km) from the Gila River and parallel to
16 Centennial Wash, and it is likely that traditionally the SEZ was a hunting and gathering area
17 exploited by groups practicing irrigation agriculture along the Gila. This is supported by the
18 presence of two known prehistoric canal systems within 5 mi (8 km) of the proposed SEZ. The
19 variability of the desert climate rendered a broad resource base necessary for survival. Access to
20 both wild and cultivated resources was desirable (Hackenberg 1983). Rural Native Americans
21 commenting on previous energy development projects in the area have voiced concern over the
22 loss of culturally important plants used for food, medicine, and ritual purposes and for tools,
23 implements, and structures (Bean et al. 1978).
24

25 The plant communities observed or likely to be present at the proposed Gillespie SEZ
26 are discussed in Section 8.3.10. According to the southwestern Gap analysis, the land cover at
27 the proposed Gillespie SEZ is predominantly Sonora-Mojave Creosotebush-White Bursage
28 Desert Scrub, interspersed with patches of Sonoran Paloverde-Mixed Cacti Desert Scrub
29 (USGS 2005a).
30

31 Native American populations have traditionally made use of hundreds of native plants.
32 Table 8.3.18.1-1 lists plants often mentioned as important by the Maricopa and O’odham that
33 either were observed at the proposed Gillespie SEZ or are probable members of the cover type
34 plant communities identified for the SEZ. These plants are the dominant species; however, other
35 plants important to Native Americans could occur in the SEZ, depending on localized conditions
36 and the season. Overall, creosotebush dominates the SEZ, while cacti, mesquite, and sparse wild
37 grasses are present. Creosotebush is important in traditional Native American medicine and as a
38 food plant. Mesquite was among the most important food plants. Its long, bean-like pods were
39 harvested in the summer, could be stored, and were widely traded; its blossoms are edible.
40 Saltbush seeds were harvested, processed, and eaten.
41

42
43 **8.3.18.1.3 Other Resources**
44

45 Water is an essential prerequisite for life in the arid areas of the Southwest. As long-time
46 desert dwellers, Native Americans have a great appreciation for the importance of water in a

TABLE 8.3.18.1-1 Plant Species Important to Native Americans Observed or Likely To Be Present in the Proposed Gillespie SEZ

Common Name	Scientific Name	Status
Food		
Cat's Claw	<i>Acacia greggii</i>	Possible
Cholla Cactus	<i>Opuntia</i> spp.	Observed
Creosotebush	<i>Larrea tridentata</i>	Observed
Honey Mesquite	<i>Prosopis Glandolosa</i>	Possible
Ironwood	<i>Olneya tesota</i>	Possible
Prickly Pear Cactus	<i>Opuntia</i> spp.	Possible
Saguaro Cactus	<i>Carnegiea gigantean</i>	Observed
Saltbush	<i>Atriplex</i> spp.	Possible
Screwbean Mesquite	<i>Prosopis pubescens</i>	Possible
Wolfberry	<i>Lycium fremontii</i>	Possible
Yellow Paloverde	<i>Parkinsonia microphylla</i>	Observed
Medicine		
Creosotebush	<i>Larrea tridentata</i>	Possible
Screwbean Mesquite	<i>Prosopis pubescens</i>	Possible
Unspecified		
Bursage (Burro Bush)	<i>Ambrosia dumosa</i>	Possible

Sources: Field visit; Bean et al. (1978); Russell (1975); Hackenberg (1983); USGS (2005a).

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3 desert environment. They have expressed concern over the use and availability of water for solar
4 energy installations (Jackson 2009). Tribes are also sensitive about the use of scarce local water
5 supplies for the benefit of distant communities and recommend that determination of adequate
6 water supplies be a primary consideration for whether a site is suitable for the development of
7 a utility-scale solar energy facility (Moose 2009). Water is a particularly sensitive issue for
8 southern Arizona Tribes, who in the past have seen their ancestral water rights ignored and water
9 they depended on for irrigation diverted by Euro-American settlers (DeJong 2004, 2007). While
10 no surface water flows through the proposed SEZ, the effects of pumping groundwater on Native
11 American water rights is of concern.

12
13 Close to riverine settlements and along the trail network that linked the Gila River with
14 the Colorado River, the proposed Gillespie SEZ would have been well known to dwellers along
15 the river. Any plant or animal resources available would have been exploited. The Gila Bend
16 Mountains adjacent to the proposed SEZ on the southwest provide habitat for deer and bighorn
17 sheep, which may occasionally have been present in the valley as well. Pronghorn antelope are
18 possible in the area. While big game was highly prized, smaller animals, such as black-tailed
19 jackrabbits and desert cottontail, traditionally provided a larger proportion of the protein in the
20 Native American diet (Spier 1970). The proposed SEZ provides suitable habitat for both.
21 Wildlife likely to be found in the proposed Gillespie SEZ is described in Section 8.3.11. Native

American game species whose range includes the SEZ are listed in Table 8.3.18.1-2. Native Americans have expressed concern over ecological segmentation, that is, development that fragments animal habitat and does not provide corridors for movement. They would prefer solar energy development take place on land that has already been disturbed, such as abandoned farmland, rather than on undisturbed ground (Jackson 2009).

Mineral resources important to Native Americans in the Sonoran Desert include clay for pottery, stone for making tools, and minerals for pigments. None of these has been reported in the proposed Gillespie SEZ.

8.3.18.2 Impacts

The impact of development of the SEZ on water resources is likely to be of major concern to affected Tribes. The San Lucy District of the Tohono O’odham Reservation (Gila Bend Reservation) is just 16 mi (26 km) south and downstream of the proposed SEZ. Extreme groundwater drawdown in the area of the proposed Gillespie SEZ could result in less groundwater inflow into the Gila Bend groundwater basin, leading to some depletion over time in the aquifer underlying the reservation.

TABLE 8.3.18.1-2 Animal Species Used by Native Americans Whose Range Includes the Proposed Gillespie SEZ

Common Name	Scientific Name	Status
Mammals		
Badger	<i>Taxidea taxus</i>	All year
Bighorn sheep	<i>Ovis Canadensis</i>	All year
Black-tailed jackrabbit	<i>Lepus californicus.</i>	All year
Desert cottontail	<i>Silvilagus audubonii</i>	All year
Kit fox	<i>Vulpes macotis</i>	All year
Mountain lion	<i>Puma concolor</i>	All year
Mule deer	<i>Odocoileus hemionus.</i>	All year
Pronghorn	<i>Antilocapra Americana</i>	All year
Wood rats	<i>Neotoma spp.</i>	All year
Birds		
Doves	<i>Columbina spp.</i>	All year
	<i>Zenaida spp.</i>	All year
Gambel’s quail	<i>Callipepla gambelii</i>	All year

Sources: Hackenberg (1983); Russell (1975); Spier (1970); USGS (2005b).

1 Other impacts that would be expected from solar energy development within the
2 proposed Gillespie SEZ on resources important to Native Americans fall into two major
3 categories: impacts on the landscape and impacts on discrete localized resources.
4

5 Potential landscape-scale impacts are those caused by the presence of an industrial
6 facility within a cultural landscape that includes sacred mountains and other geophysical features
7 often tied together by a network of trails. Impacts may be visual—the intrusion of an industrial
8 feature in sacred space; audible—noise from the construction, operation or decommissioning of a
9 facility detracting from the traditional cultural values of the site; or demographic—the presence
10 of a larger number of outsiders in the area that would increase the chance that the cultural
11 importance of the area would be degraded by increased foot and motorized traffic. In
12 past consultations, the Gila Bend Mountains have been identified as culturally important
13 (Bean et al. 1978). As consultation with the Tribes continues and project-specific analyses
14 are undertaken, it is possible that there will be Native American concerns expressed over
15 potential visual effects on the landscape of solar energy development within the proposed SEZ.
16

17 Localized effects could occur both within the proposed SEZ and in adjacent areas. Within
18 the SEZ these effects would include the destruction or degradation of important plant resources,
19 destruction of the habitat of and interference with the movement of culturally important animal
20 species, destruction of archaeological sites and burials, and the degradation or destruction of
21 trails. Plant resources are known to exist in the SEZ. Any ground-disturbing activity associated
22 with development within the SEZ has the potential for destroying localized resources. However,
23 significant tracts of Sonora-Mojave Creosote Bursage Desert Scrub and Sonoran Paloverde-
24 Mixed Cacti Desert Scrub would remain outside the SEZ, and anticipated overall effects on these
25 plant populations would be small. Animal species important to Native Americans are shown in
26 Table 18.3.18.1-2. While the construction of utility-scale solar energy facilities would reduce the
27 amount of habitat available to many of these species, similar habitat is abundant and the effect on
28 animal populations is likewise likely to be small.
29

30 Since solar energy facilities cover large tracts of ground, even taking into account the
31 implementation of programmatic design features, it is unlikely that avoidance of all resources
32 would be possible. Programmatic design features (see Appendix A, Section A.2.2) assume that
33 the necessary cultural surveys, site evaluations, and Tribal consultations will occur.
34 Implementation of programmatic design features, as discussed in Appendix A, Section A.2.2,
35 should eliminate impacts on Tribes' reserved water rights and the potential for groundwater
36 contamination issues.
37
38

39 **8.3.18.3 SEZ-Specific Design Features and Design Feature Effectiveness**

40
41 Programmatic design features to mitigate impacts of potential concern to Native
42 Americans, such as avoidance of sacred sites, water sources, and Tribally important plant and
43 animal species, are provided in Appendix A, Section A.2.2.
44

1 The need for and nature of SEZ-specific design features regarding potential issues of
2 concern would be determined during government-to-government consultation with affected
3 Tribes listed in Table 8.3.18-1.

4
5 Mitigation of impacts on archaeological sites and traditional cultural properties is
6 discussed in Section 8.3.17.3, in addition to the mitigation strategies for historic properties
7 discussed in Section 5.15.

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1 **8.3.19 Socioeconomics**

2
3
4 **8.3.19.1 Affected Environment**

5
6 This section describes current socioeconomic conditions and local community services
7 within the ROI surrounding the proposed Gillespie SEZ. The ROI is a one-county area consisting
8 of Maricopa County in Arizona. It encompasses the area in which workers are expected to spend
9 most of their salaries and in which a portion of site purchases and nonpayroll expenditures from
10 the construction, operation, and decommissioning phases of potential future facilities in the
11 proposed SEZ are expected to take place.
12

13
14 **8.3.19.1.1 ROI Employment**

15
16 In 2008, employment in the ROI stood at 1,876,247 (Table 8.3.19.1-1). Over the period
17 1999 to 2008, the annual average employment growth rate in Maricopa County was 2.1%,
18 slightly lower than the 2.3% average rate for Arizona as a whole.
19

20 In 2006, the service sector provided the highest percentage of employment in the
21 ROI at 49%, followed by wholesale and retail trade with 18.1% (Table 8.3.19.1-2). Smaller
22 employment shares were held by construction (10.3%), finance, insurance and real estate (9.9%),
23 and manufacturing (7.3%).
24

25
26 **8.3.19.1.2 ROI Unemployment**

27
28 Over the period 1999 to 2008, the average unemployment rate in Maricopa County was
29 4.2%, slightly lower than the 4.8% average rate for all of Arizona (Table 8.3.19.1-3). The
30 unemployment rate for 2009 (8.3%) contrasts with the rate for 2008 (5.1%). The average rate
31
32

TABLE 8.3.19.1-1 ROI Employment for the Proposed Gillespie SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Maricopa County	1,531,553	1,876,247	2.1
Arizona	2,355,357	2,960,199	2.3

Sources: U.S. Department of Labor (2009a,b).

TABLE 8.3.19.1-2 ROI Employment for the Proposed Gillespie SEZ, by Sector, 2006

Industry	Maricopa County	% of Total
Agriculture ^a	11,098	0.7
Mining	1,835	0.1
Construction	171,087	10.3
Manufacturing	120,867	7.3
Transportation and public utilities	83,990	5.0
Wholesale and retail trade	302,087	18.1
Finance, insurance, and real estate	164,953	9.9
Services	815,970	49.0
Other	91	0.0
Total	1,665,052	

^a Agricultural employment includes 2007 data for hired farmworkers.

Sources: U.S. Bureau of the Census (2009a); USDA (2009).

TABLE 8.3.19.1-3 ROI Unemployment Rates (%) for the Proposed Gillespie SEZ

Location	1999–2008	2008	2009 ^a
Maricopa County	4.2	5.1	8.3
Arizona	4.8	5.5	9.1

^a Rates for 2009 are the average for January through May.

Sources: U.S. Department of Labor (2009a–c).

for Arizona as a whole (9.1%) was also higher during this period than the corresponding average rates for 2008.

8.3.19.1.3 ROI Urban Population

The population of Maricopa County in 2008 was more than 92% urban (Table 8.3.19.1-4). The largest urban area, Phoenix, had an estimated 2008 population of 1,577,812; other large cities include Mesa (459,160), Chandler (252,885), Glendale (250,746), Scottsdale (236,496), Tempe (171,444), and Peoria (158,093). These cities are part of the

TABLE 8.3.19.1-4 ROI Urban Population and Income for the Proposed Gillespie SEZ

City	Population		Average Annual Growth Rate, 2000–2008 (%)	Median Household Income (\$ 2008)		Average Annual Growth Rate, 1999 and 2006–2008 (%) ^a
	2000	2008		1999	2006–2008	
Phoenix	1,321,045	1,577,812	2.2	53,055	49,933	-0.7
Mesa	396,375	459,160	1.9	55,128	51,180	-0.8
Chandler	176,581	252,885	4.6	75,211	70,924	-0.7
Glendale	218,812	250,746	1.7	57,957	52,083	-1.2
Scottsdale	202,705	236,496	1.9	74,012	72,033	-0.3
Gilbert	109,697	211,892	8.6	87,592	80,705	-0.9
Tempe	158,625	171,444	1.0	54,540	50,147	-0.9
Peoria	108,364	158,093	4.8	67,207	65,730	-0.2
Surprise	30,848	92,679	14.7	56,852	64,465	1.4
Avondale	35,883	81,111	10.7	63,285	61,665	-0.3
Goodyear	18,911	62,170	16.0	74,022	76,823	0.4
Buckeye	6,537	47,340	28.1	45,814	65,514	4.1
Fountain Hills	20,235	25,170	2.8	79,335	81,377	0.3
El Mirage	7,609	24,701	15.9	43,535	52,109	2.0
Queen Creek	4,316	23,850	23.8	82,017	78,828	-0.4
Paradise Valley	13,664	14,949	1.1	193,421	NA ^b	NA
Tolleson	4,974	7,179	4.7	49,921	NA	NA
Wickenburg	5,082	6,618	3.4	40,835	NA	NA
Guadalupe	5,228	5,936	1.6	38,740	NA	NA
Cave Creek	3,728	5,416	4.8	77,171	NA	NA
Litchfield Park	3,810	5,116	3.8	92,540	NA	NA
Youngtown	3,010	4,885	6.2	29,824	NA	NA
Carefree	2,927	3,852	3.5	114,205	NA	NA
Gila Bend	1,980	1,830	-1.0	34,744	NA	NA

^a Data are averages for the period 2006–2008.

^b NA = data not available.

Source: U.S. Bureau of the Census (2009b-d).

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Phoenix metropolitan region, and most are more than 100 mi (160 km) from the site of the proposed SEZ.

Population growth rates among the cities in Maricopa County have varied over the period 2000 and 2008. Buckeye grew at an annual rate of 28.1% during this period; higher than average growth was also experienced in Queen Creek (23.8%), Goodyear (16%), El Mirage (15.9%), Surprise (14.7%), and Avondale (10.7%). Seven other cities in the county had growth rates that were higher than the state average of 3.5%.

1 **8.3.19.1.4 ROI Urban Income**

2
3 Median household incomes varied considerably across cities in Maricopa County
4 (Table 8.3.19.1-4). Ten of the cities for which data are available for 2006 to 2008 had median
5 household incomes that were higher than the state average of \$56,348. Fountain Hills (\$81,377)
6 and Gilbert (\$80,705) had the highest incomes. A number of cities, including Paradise Valley
7 (\$193,421), Carefree (\$114,205), Litchfield Park (\$92,540), and Cave Creek (\$77,171), had
8 median incomes in 1999 that were higher than the state average of \$57,999. Five cities, including
9 Phoenix (\$49,933), Tempe (\$50,147), and Mesa (\$51,180) had median incomes in 2006 to 2008
10 that were lower than the state average.

11
12 Among the cities in Maricopa County for which data are available, median income
13 growth rates between 1999 and 2006 to 2008 were highest in Buckeye (4.1%), El Mirage (2.0%)
14 and Surprise (1.4%), with annual growth rates of less than 1% elsewhere. Ten cities in the county
15 had negative income growth rates between 1999 and 2006 to 2008. The average median
16 household income growth rate for the state as a whole over this period was -0.2%.

17
18
19 **8.3.19.1.5 ROI Population**

20
21 Table 8.3.19.1-5 presents recent and projected population in Maricopa County and in
22 the state as a whole. Population in the county stood at 3,958,263 in 2008, having grown at an
23 average annual rate of 3.2% since 2000. Population growth in the county was slightly higher
24 than the 3.0% experienced by Arizona as a whole over the same period. The county population
25 is expected to increase to 5,374,643 by 2021 and to 5,568,104 by 2023.

26
27
28 **8.3.19.1.6 ROI Income**

29
30 Total personal income in Maricopa County stood at \$151.0 billion in 2007 and has grown
31 at an annual average rate of 4.0% over the period 1998 to 2007 (Table 8.3.19.1-6). Per-capita
32
33

TABLE 8.3.19.1-5 ROI Population for the Proposed Gillespie SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Maricopa County	3,072,149	3,958,263	3.2	5,374,643	5,568,104
Arizona	5,130,632	6,499,377	3.0	8,945,447	9,271,163

34 Sources: U.S. Bureau of the Census (2009e,f); Arizona Department of Commerce (2010).

TABLE 8.3.19.1-6 ROI Personal Income for the Proposed Gillespie SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
Maricopa County			
Total income ^a	101.7	151.0	4.0
Per-capita income	34,944	38,998	1.1
Arizona			
Total income ^a	149.2	215.8	3.8
Per-capita income	30,551	33,926	1.1

^a Unless indicated otherwise, values are reported in \$ billion 2008.

Sources: U.S. Department of Commerce (2009); U.S. Bureau of the Census (2009e,f).

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income in the county also rose over the same period at a rate of 1.1%, increasing from \$34,944 to \$38,998. The personal income growth rate in the county was higher than the state rate (3.8%), but the per-capita income growth rate was the same in the county as for Arizona as a whole (1.1%).

Median household income in 2006 to 2008 in Maricopa County stood at \$56,555 (U.S. Bureau of the Census 2009d).

8.3.19.1.7 ROI Housing

In 2007, almost 1,536,500 housing units were located in Maricopa County (Table 8.3.19.1-7). Owner-occupied units accounted for about 68% of the occupied units in the county, with rental housing making up 32% of the total. Vacancy rates in 2007 were 12.9% in Maricopa County. There were 198,423 vacant housing units in 2007, of which 63,356 are estimated to be rental units that would be available to construction workers. There were 49,637 seasonal, recreational, or occasional-use units vacant at the time of the 2000 Census.

Housing stock in Maricopa County grew at an annual rate of 3.0% over the period 2000 to 2007, with 286,240 new units added to the existing housing stock (Table 8.3.19.1-7).

The median value of owner-occupied housing in Maricopa County in 2006 to 2008 was \$263,600 (U.S. Bureau of the Census 2009g).

**TABLE 8.3.19.1-7 ROI Housing Characteristics
for the Proposed Gillespie SEZ**

Parameter	2000	2007 ^a
Maricopa County		
Owner-occupied	764,547	910,811
Rental	368,339	427,237
Vacant units	117,345	198,423
Seasonal and recreational use	49,637	NA ^b
Total units	1,250,231	1,536,471

^a 2007 data for number of owner-occupied, rental, and vacant units for Arizona counties are not available; data are based on 2007 total housing units and 2000 data on housing tenure.

^b NA = data not available.

Sources: U.S. Bureau of the Census (2009h-j).

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8.3.19.1.8 ROI Local Government Organizations

The various local and county government organizations in Riverside County are listed in Table 8.3.19.1-8. In addition, there are five Tribal governments located in the county; members of other Tribal groups are located in the state, but their Tribal governments are located in adjacent states.

8.3.19.1.9 ROI Community and Social Services

This section describes educational, health care, law enforcement, and firefighting resources in the ROI.

Schools

Table 8.3.19.1-9 provides summary statistics for enrollment and educational staffing and two indices of educational quality—student-teacher ratios and levels of service (number of teachers per 1,000 population). The student-teacher ratio in Maricopa County schools in 2007 was 18.8, while the level of service in Maricopa County was 8.6.

Health Care

There were 11,993 physicians in Maricopa County in 2007, and the number of doctors per 1,000 population was 3.1 (Table 8.3.19.1-10).

TABLE 8.3.19.1-8 ROI Local Government Organizations and Social Institutions for the Proposed Gillespie SEZ

Government

City

Avondale	Litchfield Park
Buckeye	Mesa
Carefree	Paradise Valley
Cave Creek	Peoria
Chandler	Phoenix
El Mirage	Queen Creek
Fountain Hills	Scottsdale
Gila Bend	Surprise
Gilbert	Tempe
Glendale	Tolleson
Goodyear	Wickenburg
Guadalupe	Youngtown

County

Maricopa County

Tribal

Ak Chin Indian Community of the Maricopa (Ak Chin) Indian Reservation, Arizona
 Fort McDowell Yavapai Nation, Arizona
 Gila River Indian Community of the Gila River Indian Reservation, Arizona
 Salt River Pima-Maricopa Indian Community of the Salt River Reservation, Arizona
 Yavapai-Apache Nation of the Camp Verde Indian Reservation, Arizona

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

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TABLE 8.3.19.1-9 ROI School District Data for the Proposed Gillespie SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service ^a
Maricopa County	624,346	33,244	18.8	8.6

^a Number of teachers per 1,000 population.

Source: NCES (2009).

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TABLE 8.3.19.1-10 Physicians in the ROI for the Proposed Gillespie SEZ, 2007

Location	Number of Primary Care Physicians	Level of Service ^a
Maricopa County	11,993	3.1

^a Number of physicians per 1,000 population.

Source: AMA (2009).

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Public Safety

Maricopa County has 763 police officers and would provide law enforcement services to the SEZ (Table 8.3.19.1-11). Currently, there are 3,154 professional firefighters in the county. Levels of service of police protection are 0.2 in Maricopa County and 0.8 for fire services.

8.3.19.1.10 ROI Social Change

Various energy development studies have suggested that once the annual growth in population is between 5 and 15% in smaller rural communities, alcoholism, depression, suicide, social conflict, divorce, and delinquency would increase, and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Tables 8.3.19.1-12 and 8.3.19.1-13 present data for a number of indicators of social change, including violent crime and property crime rates, alcoholism and illicit drug use, and mental health and divorce, that might be used to indicate social change.

The violent crime rate in Maricopa County in 2007 was 4.7 crimes per 1,000 population (Table 8.3.19.1-12), while the property-related crime rate was 43.2, producing an overall crime rate of 48.0 per 1,000 people.

Other measures of social change—alcoholism, illicit drug use, and mental health problems—are not available at the county level, and thus are presented for the Substance Abuse and Mental Health Services Administration (SAMHSA) region in which the county is located (Table 8.3.19.1-13).

8.3.19.1.11 ROI Recreation

Various areas in the vicinity of the proposed SEZ are used for recreational purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for such activities as hunting, fishing, boating, canoeing, wildlife watching, camping, hiking, horseback riding, mountain climbing, and sightseeing. These areas are discussed in Section 7.4.5.

TABLE 8.3.19.1-11 Public Safety Employment in the ROI for the Proposed Gillespie SEZ

Location	Number of Police Officers ^a	Level of Service ^b	Number of Firefighters ^c	Level of Service
Maricopa County	763	0.2	3,154	0.8

^a 2007 data.

^b Number per 1,000 population.

^c 2008 data; number does not include volunteers.

Sources: U.S. Department of Justice (2009a); Fire Departments Network (2009).

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TABLE 8.3.19.1-12 County and ROI Crime Rates in the ROI for the Proposed Gillespie SEZ^a

Location	Violent Crime ^b		Property Crime ^c		All Crime	
	Offenses	Rate	Offenses	Rate	Offenses	Rate
Maricopa County	18,719	4.7	171,143	43.2	189,682	48.0

^a Rates are the number of crimes per 1,000 population.

^b Violent crime includes murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault.

^c Property crime includes burglary, larceny, theft, motor vehicle theft, and arson.

Sources: U.S. Department of Justice (2009a,b).

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Because the number of visitors using state and federal lands for recreational activities is not available from the various administering agencies, the value of recreational resources in these areas, based solely on the number of recorded visitors, is likely to be an underestimation. In addition to visitation rates, the economic valuation of certain natural resources can also be assessed in terms of the potential recreational destination for current and future users, that is, their nonmarket value (see Section 5.17.1.1.1).

Another method of gauging the importance of recreational activity is to estimate the economic impact of the various recreational activities supported by natural resources on public land in the vicinity of the proposed solar development, by identifying sectors in the economy in which expenditures on recreational activities occur. Not all activities in these sectors are directly related to recreation on state and federal lands; some activity occurs on private land (e.g., dude ranches, golf courses, bowling alleys, and movie theaters). Expenditures associated with recreational activities form an important part of the economy of the ROI. In 2007, 193,562 people were employed in Maricopa County in the various sectors identified as recreation,

TABLE 8.3.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Gillespie SEZ ROI^a

Geographic Area	Alcoholism	Illicit Drug Use	Mental Health ^b	Divorce ^c
Arizona Maricopa	8.6	2.8	10.7	–
Arizona	NA ^d	NA	NA	3.9

^a Data for alcoholism and drug use represent the percentage of the population over 12 years of age with dependence or abuse of alcohol, illicit drugs. Data are averages for 2004 to 2006.

^b Data for mental health represent the percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

^c Divorce rates are the number of divorces per 1,000 population. Data are for 1990.

^b Data for mental health represent the percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

^d NA = Not available.

Sources: SAMHSA (2009); CDC (2009).

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constituting 10.3% of total county employment (Table 8.3.19.1-14). Recreation spending also produced almost \$4,731 million in income in the county in 2007. The primary sources of recreation-related employment were eating and drinking places.

8.3.19.2 Impacts

The following analysis begins with a description of the common impacts of solar development, including common impacts on recreation and on social change. These impacts would occur regardless of the solar technology developed in the SEZ. The impacts of developments employing various solar energy technologies are analyzed in detail in subsequent sections.

8.3.19.2.1 Common Impacts

Construction and operation of a solar energy facility at the proposed Gillespie SEZ would produce direct and indirect economic impacts. Direct impacts would occur as a result of expenditures on wages and salaries, procurement of goods and services required for project construction and operation, and the collection of state sales and income taxes. Indirect impacts would occur as project wages and salaries, procurement expenditures, and tax revenues subsequently circulated through the economy of each state, thereby creating additional employment, income, and tax revenues. Facility construction and operation would also require in-migration of workers and their families into the ROI surrounding the site, and this in-migration would affect population, rental housing, health service employment, and public

TABLE 8.3.19.1-14 ROI Recreation Sector Activity for the Proposed Gillespie SEZ, 2007

ROI	Employment	Income (\$ million)
Amusement and recreation services	8,968	225.8
Automotive rental	4,535	190.9
Eating and drinking places	140,479	2,935.0
Hotels and lodging places	19,364	706.9
Museums and historic sites	970	57.0
Recreational vehicle parks and campsites	1,302	41.9
Scenic tours	6,607	348.4
Sporting goods retailers	11,337	224.9
Total ROI	193,562	4,731.0

Source: MIG, Inc. (2010).

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3 safety employment. Socioeconomic impacts common to all utility-scale solar energy
4 developments are discussed in detail in Section 5.17. Those impacts would be minimized
5 through the implementation of programmatic design features described in Section Appendix A,
6 Section A.2.2.

7
8
9 **Recreation Impacts**

10
11 Estimating the impact of solar facilities on recreation is problematic because it is not
12 clear how solar development in the SEZ would affect recreational visitation and nonmarket
13 values (i.e., the value of recreational resources for potential or future visits; see
14 Section 5.17.1.2.3). While it is clear that some land in the ROI would no longer be accessible
15 for recreation, the majority of popular recreational locations would be precluded from solar
16 development. It is also possible that solar developments in the ROI would be visible from
17 popular recreation locations, and that construction workers residing temporarily in the ROI
18 would occupy accommodation otherwise used for recreational visits, thus reducing visitation and
19 consequently affecting the economy of the ROI.

20
21
22 **Social Change**

23
24 Although an extensive literature in sociology documents the most significant components
25 of social change in energy boomtowns, the nature and magnitude of the social impact of energy
26 facilities in small rural communities are still unclear (see Section 5.17.1.1.4). While some degree
27 of social disruption is likely to accompany large-scale in-migration during the boom phase, there
28 is insufficient evidence to predict the extent to which specific communities are likely to be
29 affected, which population groups within each community are likely to be most affected, and
30 the extent to which social disruption is likely to persist beyond the end of the boom period

1 (Smith et al. 2001). Accordingly, because of the lack of adequate social baseline data, it has
2 been suggested that social disruption is likely to occur once an arbitrary population growth rate
3 associated with solar energy development projects has been reached, with an annual rate of
4 between 5 and 10% growth in population assumed to result in a breakdown in social structures
5 and a consequent increase in alcoholism, depression, suicide, social conflict, divorce, and
6 delinquency, as well as deterioration in levels of community satisfaction (BLM 1980,
7 1983, 1996).

8
9 In overall terms, the in-migration of workers and their families into the ROI would
10 represent an increase of less than 0.1% in ROI population during construction and operation of
11 the solar trough technology, with smaller increases for the power tower, dish engine, and PV
12 technologies. It is possible that some construction and operations workers would choose to locate
13 in communities closer to the SEZ. However, because of an insufficient range of housing choices
14 to suit all solar occupations and the lack of available housing in smaller rural communities in the
15 ROI to accommodate all in-migrating workers and families, many workers are likely to commute
16 to the SEZ from larger communities elsewhere in the ROI. This would reduce the potential
17 impact of solar developments on social change. Regardless of the pace of population growth
18 associated with the commercial development of solar resources, and the likely residential
19 location of in-migrating workers and families in communities some distance from the SEZ itself,
20 the number of new residents from outside the ROI is likely to lead to some demographic and
21 social change in small rural communities in the ROI. Communities hosting solar developments
22 are likely to be required to adapt to a different quality of life, with a transition away from a more
23 traditional lifestyle involving ranching and taking place in small, isolated, close-knit,
24 homogenous communities with a strong orientation toward personal and family relationships,
25 toward a more urban lifestyle, with increasing cultural and ethnic diversity and increasing
26 dependence on formal social relationships within the community.

27 28 29 **Livestock Grazing Impacts**

30
31 Cattle ranching and farming supported 1,108 jobs and \$18.1 million in income in the ROI
32 in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed
33 Gillespie SEZ could reduce the amount of land available for livestock grazing within the SEZ,
34 resulting in total (direct plus indirect) impacts of the loss of less than 1 job and less than
35 \$0.1 million in income in the ROI. There would also be a decline in grazing fees payable to the
36 BLM and to the USFS by individual permittees based on the number of AUMs required to
37 support livestock on public land. Assuming the 2008 fee of \$1.35 per AUM, grazing fee losses
38 would amount to \$74 annually on land dedicated to solar developments in the SEZ.

39 40 41 **Access Road Impacts**

42
43 The impacts of construction of an access road connecting the proposed SEZ to the
44 existing road network could include the addition of 244 jobs in the ROI (including direct and
45 indirect impacts) in the peak year of construction (Table 8.3.19.2-1). Road construction
46 activities in the peak year would constitute less than 1% of total ROI employment. Access

1 road construction would also produce \$9.4 million in ROI income. Direct sales taxes would
 2 be \$0.3 million; and direct income taxes would be \$0.2 million.

3
 4 Total operations (maintenance) employment impacts in the ROI (including direct and
 5 indirect impacts) of an access road would be less than 1 job during the first year of operation
 6 (Table 8.3.19.2-1) and would also produce less than \$0.1 million in income. Direct sales taxes
 7 would be less than \$0.1 million in the first year, with direct income taxes of less than
 8 \$0.1 million.

9
 10 Construction and operation of an access road would not require the in-migration of
 11 workers and their families from outside the ROI; consequently, no impacts on housing markets
 12 in the ROI would be expected, and no new community service employment would be required
 13 in order to meet existing levels of service in the ROI.
 14
 15

TABLE 8.3.19.2-1 ROI Socioeconomic Impacts of an Access Road Connecting the Proposed Gillespie SEZ^a

Parameter	Maximum Annual Construction Impacts	Operations
Employment (no.)		
Direct	122	<1
Total	244	<1
Income ^b		
Total	9.4	<0.1
Direct state taxes ^b		
Sales	0.3	<0.1
Income	0.2	<0.1
In-migrants (no.)	0	0
Vacant housing ^c (no.)	0	0
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts assume 3 mi (5 km) of access road are required for the SEZ. Construction impacts are assessed for the peak year of construction.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1 **8.3.19.2.2 Technology-Specific Impacts**
2

3 The economic impacts of solar energy development in the proposed SEZ were measured
4 in terms of employment, income, state tax revenues (sales and income), population in-migration,
5 housing, and community service employment (education, health, and public safety). More
6 information on the data and methods used in the analysis can be found in Appendix M.
7

8 The assessment of the impact of the construction and operation of each technology was
9 based on SEZ acreage, assuming 80% of the area could be developed. To capture a range of
10 possible impacts, solar facility size was estimated on the basis of land requirements of various
11 solar technologies, assuming that 9 acres/MW (0.04 km²/MW) would be required for power
12 tower, dish engine, and PV technologies, and 5 acres/MW (0.02 km²/MW) would be required for
13 solar trough technologies. Impacts of multiple facilities employing a given technology at each
14 SEZ were assumed to be the same as impacts for a single facility with the same total capacity.
15 Construction impacts were assessed for a representative peak year of construction, assumed to be
16 2021 for each technology. Construction impact assessments assumed that a maximum of one
17 project could be constructed within a given year, with a corresponding maximum land
18 disturbance of up to 2,094 acres (8.5 km²). For operations impacts, a representative first year of
19 operations was assumed to be 2023 for trough and power tower; 2022 was assumed for the
20 minimum facility size for dish engine and PV, and 2023 for the maximum facility size for these
21 technologies. The years of construction and operations were selected as representative of the
22 entire 20-year study period, because they are the approximate midpoint; construction and
23 operations could begin earlier.
24

25
26 **Solar Trough**
27

28
29 **Construction.** Total construction employment impacts in the ROI (including direct
30 and indirect impacts) from the use of solar trough technologies would be up to 3,813 jobs
31 (Table 8.3.19.2-2). Construction activities would constitute 0.1% of total ROI employment.
32 A solar development would also produce \$236.4 million in income. Direct sales taxes would
33 be \$9.6 million, direct income taxes \$4.4 million.
34

35 Given the scale of construction activities and the likelihood of local worker availability
36 in the required occupational categories, construction of a solar facility means that some
37 in-migration of workers and their families from outside the ROI would be required, with
38 519 persons in-migrating into the ROI. Although in-migration may potentially affect local
39 housing markets, the relatively small number of in-migrants and the availability of temporary
40 accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar
41 facility construction on the number of vacant rental housing units is not expected to be large,
42 with 259 rental units expected to be occupied in the ROI. This occupancy rate would represent
43 0.3% of the vacant rental units expected to be available in the ROI.
44

45 In addition to the potential impact on housing markets, in-migration would also affect
46 community service employment (education, health, and public safety). An increase in such

1 employment would be required to meet existing levels of service in the ROI. Accordingly,
2 four new teachers, two physicians, and one public safety employee (career firefighters or
3 uniformed police officers) would be required in the ROI. These increases would represent
4 less than 0.1% of total ROI employment expected in these occupations.
5
6

7 **Operations.** Total operations employment impacts in the ROI (including direct and
8 indirect impacts) of a build-out using solar trough technologies would be 150 jobs
9 (Table 8.3.19.2-2). Such a solar development would also produce \$5.9 million in income.
10 Direct sales taxes would be \$0.1 million, direct income taxes \$0.1 million. Based on fees
11 established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), acreage rental
12 payments would be \$0.5 million, and solar generating capacity payments would total at least
13 \$2.8 million.
14

15 Given the likelihood of local worker availability in the required occupational categories,
16 operation of a solar facility means that some in-migration of workers and their families from
17 outside the ROI would be required, with 12 persons in-migrating into the ROI. Although
18 in-migration may potentially affect local housing markets, the relatively small number of
19 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home
20 parks) mean that the impact of solar facility operation on the number of vacant owner-occupied
21 housing units is not expected to be large, with 10 owner-occupied units expected to be occupied
22 in the ROI.
23

24 No new community service employment would be required to meet existing levels of
25 service in the ROI.
26
27

28 **Power Tower**

29
30

31 **Construction.** Total construction employment impacts in the ROI (including direct
32 and indirect impacts) from the use of power tower technologies would be up to 1,519 jobs
33 (Table 8.3.19.2-3). Construction activities would constitute 0.1% of total ROI employment. Such
34 a solar development would also produce \$94.2 million in income. Direct sales taxes would be
35 around \$3.8 million, direct income taxes \$1.8 million.
36

37 Given the scale of construction activities and the likelihood of local worker availability
38 in the required occupational categories, construction of a solar facility means that some
39 in-migration of workers and their families from outside the ROI would be required, with
40 207 persons in-migrating into the ROI. Although in-migration may potentially affect local
41 housing markets, the relatively small number of in-migrants and the availability of temporary
42 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
43 construction on the number of vacant rental housing units is not expected to be large, with
44 103 rental units expected to be occupied in the ROI. This occupancy rate would represent 0.1%
45 of the vacant rental units expected to be available in the ROI.
46

TABLE 8.3.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Gillespie SEZ with Solar Trough Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	1,218	91
Total	3,813	150
Income ^b		
Total	236.4	5.9
Direct state taxes ^b		
Sales	9.6	0.1
Income	4.4	0.1
BLM payments (\$ million 2008)		
Rental	NA ^d	0.5
Capacity ^c	NA	2.8
In-migrants (no.)	519	12
Vacant housing ^e (no.)	259	10
Local community service employment		
Teachers (no.)	4	0
Physicians (no.)	2	0
Public safety (no.)	1	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 419 MW (corresponding to 2,094 acres [8.5 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 419MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^d NA = not applicable.

^e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

TABLE 8.3.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Gillespie SEZ with Power Tower Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	485	47
Total	1,519	67
Income ^b		
Total	94.2	2.3
Direct state taxes ^b		
Sales	3.8	<0.1
Income	1.8	0.1
BLM payments (\$ million 2008)		
Rental	NA ^d	0.5
Capacity ^c	NA	1.5
In-migrants (no.)	207	6
Vacant housing ^e (no.)	103	5
Local community service employment		
Teachers (no.)	2	0
Physicians (no.)	1	0
Public safety (no.)	0	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 233 MW (corresponding to 2,094 acres [8.5 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 233 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^d NA = not applicable.

^e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1 In addition to the potential impact on housing markets, in-migration would affect
2 community service (education, health, and public safety) employment. An increase in such
3 employment would be required to meet existing levels of service in the ROI. Accordingly,
4 two new teachers and one physician would be required in the ROI. These increases would
5 represent less than 0.1% of total ROI employment expected in these occupations.
6
7

8 **Operations.** Total operations employment impacts in the ROI (including direct and
9 indirect impacts) of a build-out using power tower technologies would be 67 jobs
10 (Table 8.3.19.2-3). Such a solar development would also produce \$2.3 million in income.
11 Direct sales taxes would be less than \$0.1 million; direct income taxes \$0.1 million. Based on
12 fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), acreage
13 rental payments would be \$0.5 million, and solar generating capacity payments would total at
14 least \$1.5 million.
15

16 Given the likelihood of local worker availability in the required occupational categories,
17 operation of a solar facility means that some in-migration of workers and their families from
18 outside the ROI would be required, with six persons in-migrating into the ROI. Although
19 in-migration may potentially affect local housing markets, the relatively small number of
20 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home
21 parks) would mean that the impact of solar facility operation on the number of vacant
22 owner-occupied housing units is not expected to be large, with five owner-occupied units
23 expected to be required in the ROI. No new community service employment would be required
24 to meet existing levels of service in the ROI.
25
26

27 **Dish Engine**

28
29

30 **Construction.** Total construction employment impacts in the ROI (including direct
31 and indirect impacts) from the use of dish engine technologies would be up to 617 jobs
32 (Table 8.3.19.2-4). Construction activities would constitute less than 0.1% of total ROI
33 employment. Such a solar development would also produce \$38.3 million in income. Direct
34 sales taxes would be \$1.6 million, with direct income taxes of \$0.7 million.
35

36 Given the scale of construction activities and the likelihood of local worker availability
37 in the required occupational categories, construction of a solar facility means that some
38 in-migration of workers and their families from outside the ROI would be required, with
39 84 persons in-migrating into the ROI. Although in-migration may potentially affect local
40 housing markets, the relatively small number of in-migrants and the availability of temporary
41 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
42 construction on the number of vacant rental housing units is not expected to be large, with
43 42 rental units expected to be occupied in the ROI. This occupancy rate would represent less
44 than 0.1% of the vacant rental units expected to be available in the ROI.
45

TABLE 8.3.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Gillespie SEZ with Dish Engine Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	197	46
Total	617	65
Income ^b		
Total	38.3	2.3
Direct state taxes ^b		
Sales	1.6	<0.1
Income	0.7	0.1
BLM payments (\$ million 2008)		
Rental	NA ^d	0.5
Capacity ^c	NA	1.5
In-migrants (no.)	84	6
Vacant housing ^e (no.)	42	5
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 233 MW (corresponding to 2,094 acres [8.5 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 233 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^d NA = not applicable.

^e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1 In addition to the potential impact on housing markets, in-migration would affect
2 community service (education, health, and public safety) employment. An increase in such
3 employment would be required to meet existing levels of service in the ROI. Accordingly,
4 one new teacher would be required in the ROI. This increase would represent less than 0.1%
5 of total ROI employment expected in this occupation.
6
7

8 **Operations.** Total operations employment impacts in the ROI (including direct
9 and indirect impacts) of a build-out using dish engine technologies would be 65 jobs
10 (Table 8.3.19.2-4). Such a solar development would also produce \$2.3 million in income.
11 Direct sales taxes would be less than \$0.1 million, direct income taxes \$0.1 million. Based on
12 fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), acreage
13 rental payments would be \$0.5 million, and solar generating capacity payments would total at
14 least \$1.5 million.
15

16 Given the likelihood of local worker availability in the required occupational categories,
17 operation of a dish engine solar facility means that some in-migration of workers and their
18 families from outside the ROI would be required, with six persons in-migrating into the ROI.
19 Although in-migration may potentially affect local housing markets, the relatively small number
20 of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile
21 home parks) mean that the impact of solar facility operation on the number of vacant owner-
22 occupied housing units is not expected to be large, with five owner-occupied units expected to
23 be required in the ROI.
24

25 No new community service employment would be required to meet existing levels of
26 service in the ROI.
27

28 **Photovoltaic**

29
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31

32 **Construction.** Total construction employment impacts in the ROI (including direct and
33 indirect impacts) from the use of PV technologies would be up to 288 jobs (Table 8.3.19.2-5).
34 Construction activities would constitute less than 0.1% of total ROI employment. Such a solar
35 development would also produce \$17.8 million in income. Direct sales taxes would be about
36 \$0.7 million, direct income taxes \$0.3 million.
37

38 Given the scale of construction activities and the likelihood of local worker availability
39 in the required occupational categories, construction of a solar facility means that some
40 in-migration of workers and their families from outside the ROI would be required, with
41 29 persons in-migrating into the ROI. Although in-migration may potentially affect local
42 housing markets, the relatively small number of in-migrants and the availability of temporary
43 accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility
44 construction on the number of vacant rental housing units is not expected to be large, with
45 20 rental units expected to be occupied in the ROI. This occupancy rate would represent less
46 than 0.1% of the vacant rental units expected to be available in the ROI.

TABLE 8.3.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Gillespie SEZ with PV Facilities^a

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	92	5
Total	288	6
Income ^b		
Total	17.8	0.2
Direct state taxes ^b		
Sales	0.7	<0.1
Income	0.3	<0.1
BLM payments (\$ million 2008)		
Rental	NA ^d	0.5
Capacity ^c	NA	1.2
In-migrants (no.)	39	1
Vacant housing ^e (no.)	20	1
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 233 MW (corresponding to 2,094 acres [8.5 km²] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 233 MW.

^b Unless indicated otherwise, values are reported in \$ million 2008.

^c The BLM annual capacity payment was based on a fee of \$5,256 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), assuming full build-out of the site.

^d NA = not applicable.

^e Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

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3

1 No new community service employment would be required to meet existing levels of
2 service in the ROI.

3
4
5 **Operations.** Total operations employment impacts in the ROI (including direct and
6 indirect impacts) of a build-out using PV technologies would be 6 jobs (Table 8.3.19.2-5). Such
7 a solar development would also produce \$0.2 million in income. Direct sales taxes would be less
8 than \$0.1 million, direct income taxes less than \$0.1 million. Based on fees established by the
9 BLM in its Solar Energy Interim Rental Policy (BLM 2010e), acreage rental payments would be
10 \$0.5 million, and solar generating capacity payments would total at least \$1.2 million.

11
12 Given the likelihood of local worker availability in the required occupational categories,
13 operation of a solar facility means that some in-migration of workers and their families from
14 outside the ROI would be required, with one person in-migrating into the ROI. Although
15 in-migration may potentially affect local housing markets, the relatively small number of
16 in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home
17 parks) mean that the impact of solar facility operation on the number of vacant owner-occupied
18 housing units is not expected to be large, with one owner-occupied unit expected to be required
19 in the ROI.

20
21 No new community service employment would be required to meet existing levels of
22 service in the ROI.

23 24 25 **8.3.19.3 SEZ-Specific Design Features and Design Feature Effectiveness**

26
27 No SEZ-specific design features addressing socioeconomic impacts have been identified
28 for the proposed Gillespie SEZ. Implementing the programmatic design features described in
29 Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the
30 potential for socioeconomic impacts during all project phases.

1 **8.3.20 Environmental Justice**

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3
4 **8.3.20.1 Affected Environment**

5
6 On February 11, 1994, the President signed Executive Order 12898 “Federal Actions to
7 Address Environmental Justice in Minority Populations and Low-Income Populations,” which
8 formally requires federal agencies to incorporate environmental justice as part of their missions
9 (*Federal Register*, Volume 59, page 76297, Feb. 11, 1994). Specifically, it directs them to
10 address, as appropriate, any disproportionately high and adverse human health or environmental
11 effects of their actions, programs, or policies on minority and low-income populations.
12

13 The analysis of the impacts of solar energy projects on environmental justice issues
14 follows guidelines described in the CEQ’s *Environmental Justice Guidance under the National*
15 *Environmental Policy Act* (CEQ 1997). The analysis method has three parts: (1) a description
16 of the geographic distribution of low-income and minority populations in the affected area is
17 undertaken; (2) an assessment is conducted to determine whether construction and operation
18 would produce impacts that are high and adverse; and (3) if impacts are high and adverse, a
19 determination is made as to whether they disproportionately affect minority and low-income
20 populations.
21

22 Construction and operation of solar energy projects in the proposed SEZ could affect
23 environmental justice if any adverse health or environmental impacts resulting from either phase
24 of development are significantly high and if these impacts would disproportionately affect
25 minority and low-income populations. If the analysis determines that health and environmental
26 impacts are not significant, there can be no disproportionate impacts on minority and low-income
27 populations. In the event impacts are significant, disproportionality would be determined by
28 comparing the proximity of any high and adverse impacts with the location of low-income and
29 minority populations.
30

31 The analysis of environmental justice issues associated with the development of
32 solar facilities considered impacts within the proposed Gillespie SEZ and within a region
33 encompassing a 50-mi (80-km) radius around the boundary of the SEZ. A description of the
34 geographic distribution of minority and low-income groups in the affected area was based on
35 demographic data from the 2000 Census (U.S. Bureau of the Census 2009k,1). The following
36 definitions were used to define minority and low-income population groups:
37

- 38 • **Minority.** Persons are included in the minority category if they identify
39 themselves as belonging to any of the following racial groups: (1) Hispanic,
40 (2) Black (not of Hispanic origin) or African American, (3) American Indian
41 or Alaska Native, (4) Asian, or (5) Native Hawaiian or Other Pacific Islander.
42

43 Beginning with the 2000 Census, where appropriate, the census form allows
44 individuals to designate multiple population group categories to reflect their
45 ethnic or racial origin. In addition, persons who classify themselves as being
46 of multiple racial origin may choose up to six racial groups as the basis of

1 their racial origins. The term minority includes all persons, including those
2 classifying themselves in multiple racial categories, except those who
3 classify themselves as not of Hispanic origin and as White or “Other Race”
4 (U.S. Bureau of the Census 2009k).

5
6 The CEQ guidance proposed that minority populations should be identified
7 where either (1) the minority population of the affected area exceeds 50%, or
8 (2) the minority population percentage of the affected area is meaningfully
9 greater than the minority population percentage in the general population or
10 other appropriate unit of geographic analysis.

11
12 The PEIS applies both criteria in using the Census Bureau data for census
13 block groups, wherein consideration is given to the minority population that
14 is both greater than 50% and 20 percentage points higher than in the state
15 (the reference geographic unit).

- 16
17 • **Low-Income.** Individuals are included in the low-income category if they fall
18 below the poverty line. The poverty line takes into account family size and
19 age of individuals in the family. In 1999, for example, the poverty line for a
20 family of five with three children younger than 18 was \$19,882. For any given
21 family below the poverty line, all family members are considered as being
22 below the poverty line for the purposes of analysis (U.S. Bureau of the
23 Census 2009I).

24
25 The data in Table 8.3.20.1-1 show the minority and low-income composition of the
26 total population located in the region of proposed SEZ based on 2000 Census data and CEQ
27 guidelines. Individuals identifying themselves as Hispanic or Latino are included in the table
28 as a separate entry. However, because Hispanics can be of any race, this number also includes
29 individuals identifying themselves as being part of one or more of the population groups listed
30 in the table.

31
32 A large number of minority and low-income individuals are located in the 50-mi (80-km)
33 area around the boundary of the SEZ. Within the 50-mi (80-km) radius in Arizona, 44.5% of the
34 population is classified as minority, while 15.5% is classified as low-income. Although the
35 number of minority individuals does not exceed 50% of the total population in the area, the
36 number of minority individuals exceeds the state average by 20 percentage points or more,
37 meaning that there is a minority population in the SEZ area based on 2000 Census data and
38 CEQ guidelines. The number of low-income individuals does not exceed the state average by
39 20 percentage points or more and does not exceed 50% of the total population in the area,
40 meaning that there are no low-income populations in the SEZ region.

41
42 Figures 8.3.20.1-1 and 8.3.20.1-2 show the locations of the minority and low-income
43 population groups within the 50-mi (80-km) radius around the boundary of the SEZ.

44
45 At the individual block group level there are census block groups where the minority
46 population exceeds the state average by more than 20 percentage points. These groups occur in

TABLE 8.3.20.1-1 Minority and Low-Income Populations within a 50-mi (80-km) Radius Surrounding the Proposed Gillespie SEZ

Parameter	Arizona
Total population	1,584,763
White, non-Hispanic	878,833
Hispanic or Latino	542,160
Non-Hispanic or Latino minorities	163,770
One race	139,040
Black or African American	76,040
American Indian or Alaskan Native	29,739
Asian	29,957
Native Hawaiian or Other Pacific Islander	1,538
Some other race	1,766
Two or more races	24,730
Total minority	705,930
Low-income	240,528
Percentage minority	44.5
State percent minority	24.5
Percentage low-income	15.5
State percent low-income	13.9

Source: U.S. Bureau of the Census (2009k,1).

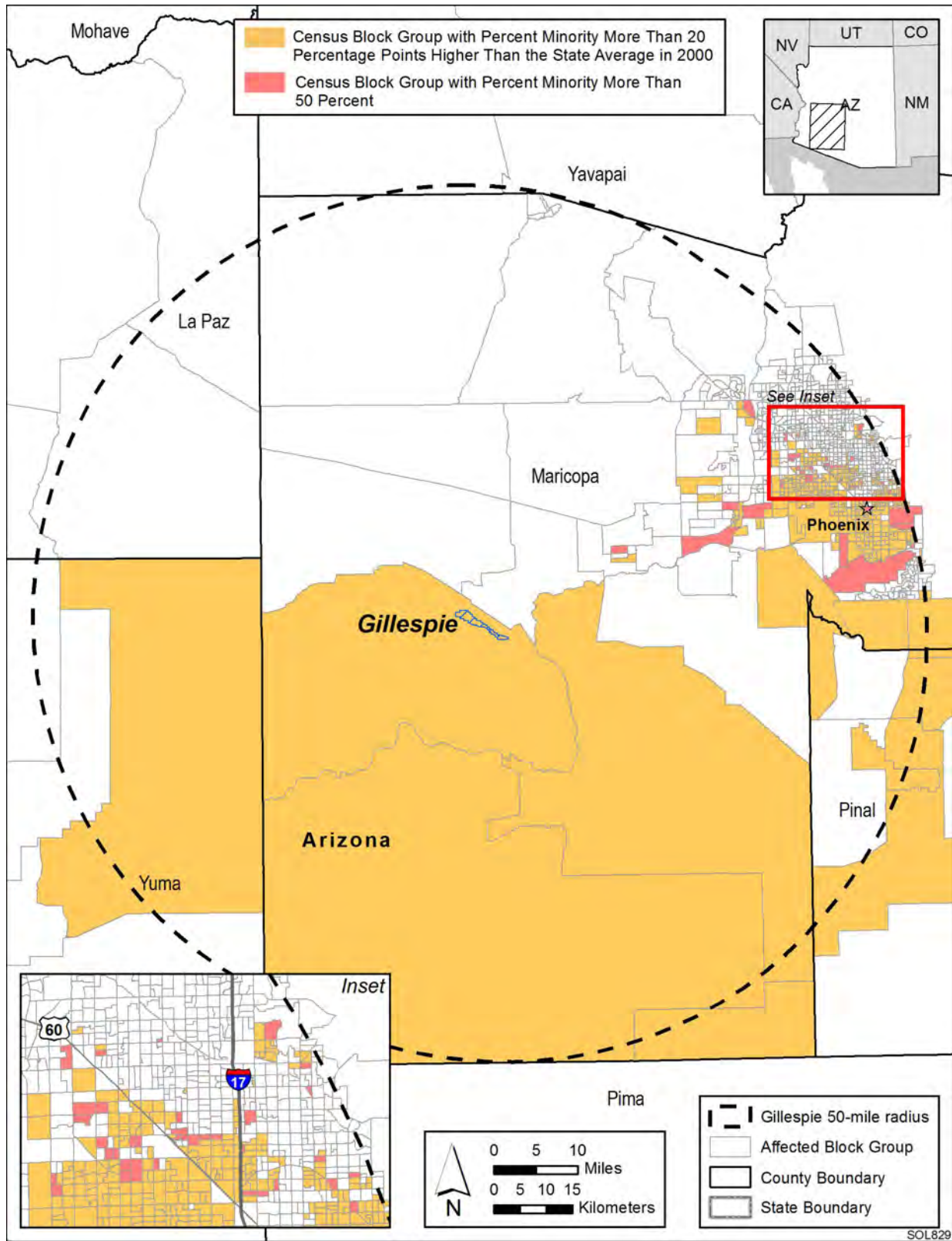
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most of the southern portion of the 50-mile (80-km) radius around the SEZ and northeast of the site, in the greater Phoenix metropolitan area. There are also block groups in the greater Phoenix area where the minority population exceeds 50% of the total population.

There is one census block group west of the SEZ, and numerous such groups in the greater Phoenix area with a low-income population that is more than 20 percentage points higher than the state average. Census block groups in which the low-income population exceeds 50% of the total population are located west of the SEZ in Yuma County, southwest of the site, and east of the site, in the greater Phoenix area.

8.3.20.2 Impacts

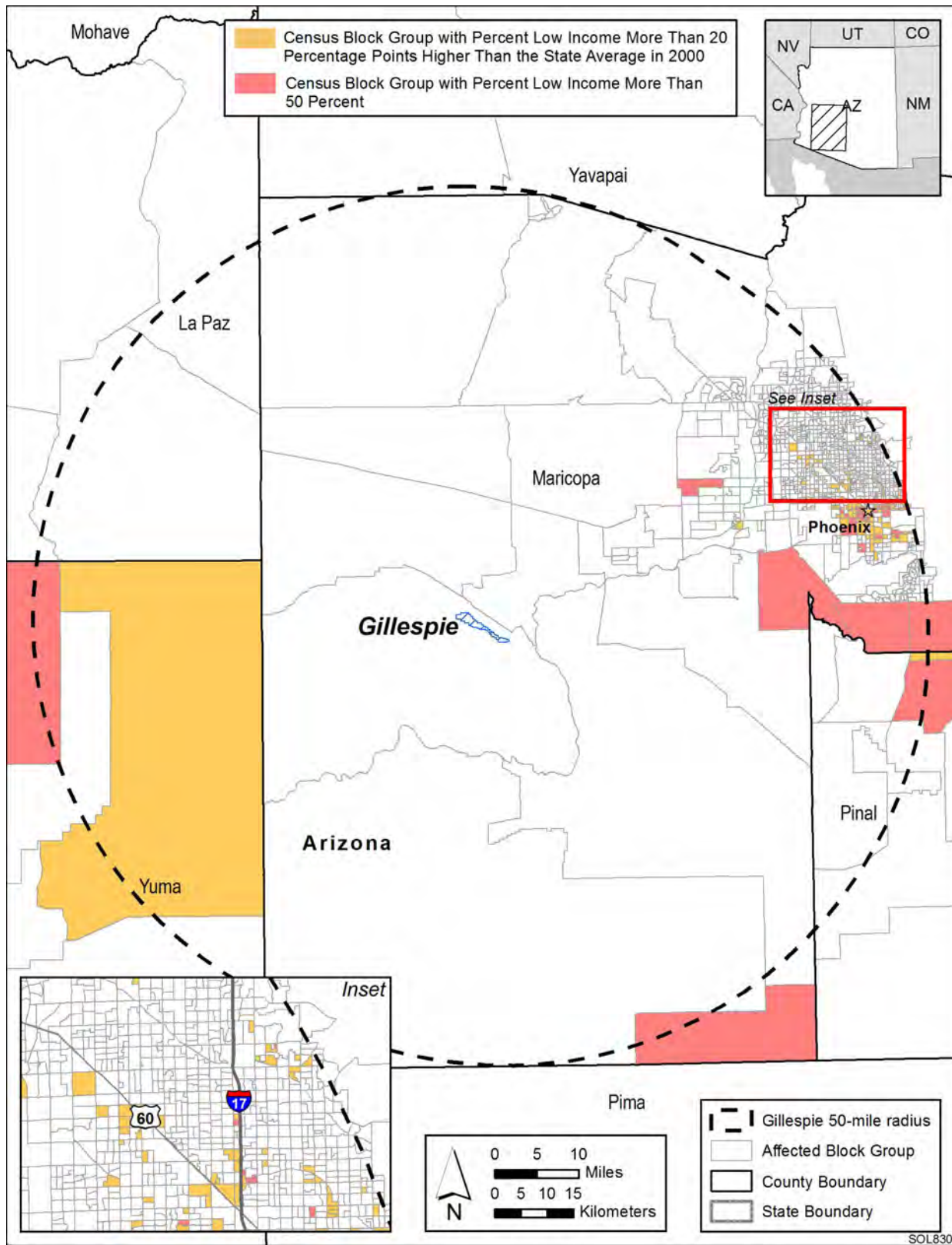
Environmental justice concerns common to all utility-scale solar energy facilities are described in detail in Section 5.18. These impacts will be minimized through the implementation



1

2 **FIGURE 8.3.20.1-1 Minority Population Groups within a 50-mi (80-km) Radius Surrounding the**

3 **Proposed Gillespie SEZ**



1

2 **FIGURE 8.3.20.1-2 Low-Income Population Groups within a 50-mi (80-km) Radius Surrounding**
 3 **the Proposed Gillespie SEZ**

1 of programmatic design features described in Appendix A, Section A.2.2, which address the
2 underlying environmental impacts contributing to the concerns. The potentially relevant
3 environmental impacts associated with solar developments within the proposed Gillespie SEZ
4 that might potentially affect minority and low-income populations include noise and dust during
5 the construction of solar facilities; noise and EMF effects associated with solar project
6 operations; the visual impacts of solar generation and auxiliary facilities, including transmission
7 lines; access to land used for economic, cultural, or religious purposes; and effects on property
8 values.

9
10 Potential impacts on low-income and minority populations could be incurred as a result
11 of the construction and operation of solar developments involving each of the four technologies.
12 Although impacts are likely to be small, there are minority populations defined by CEQ
13 guidelines (Section 13.1.20.1) within the 50-mi (80-km) radius around the boundary of the SEZ,
14 meaning that any adverse impacts of solar projects could disproportionately affect low-income
15 populations. Because there are low-income populations within the 50-mi (80-km) radius,
16 according to CEQ guidelines, there could be impacts on minority populations.

17 18 19 **8.3.20.3 SEZ-Specific Design Features and Design Feature Effectiveness**

20
21 No SEZ-specific design features addressing socioeconomic impacts have been identified
22 for the proposed Gillespie SEZ. Implementing the programmatic design features described in
23 Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the
24 potential for environmental justice impacts during all project phases.
25

1 **8.3.21 Transportation**
2

3 The proposed Gillespie SEZ is accessible by road and rail. One U.S. highway (Old
4 U.S. 80) serves the immediate area, as does a major railroad. A number of smaller airports and
5 one large airport serve the region. General transportation considerations and impacts are
6 discussed in Section 3.4 and Section 5.19, respectively.
7

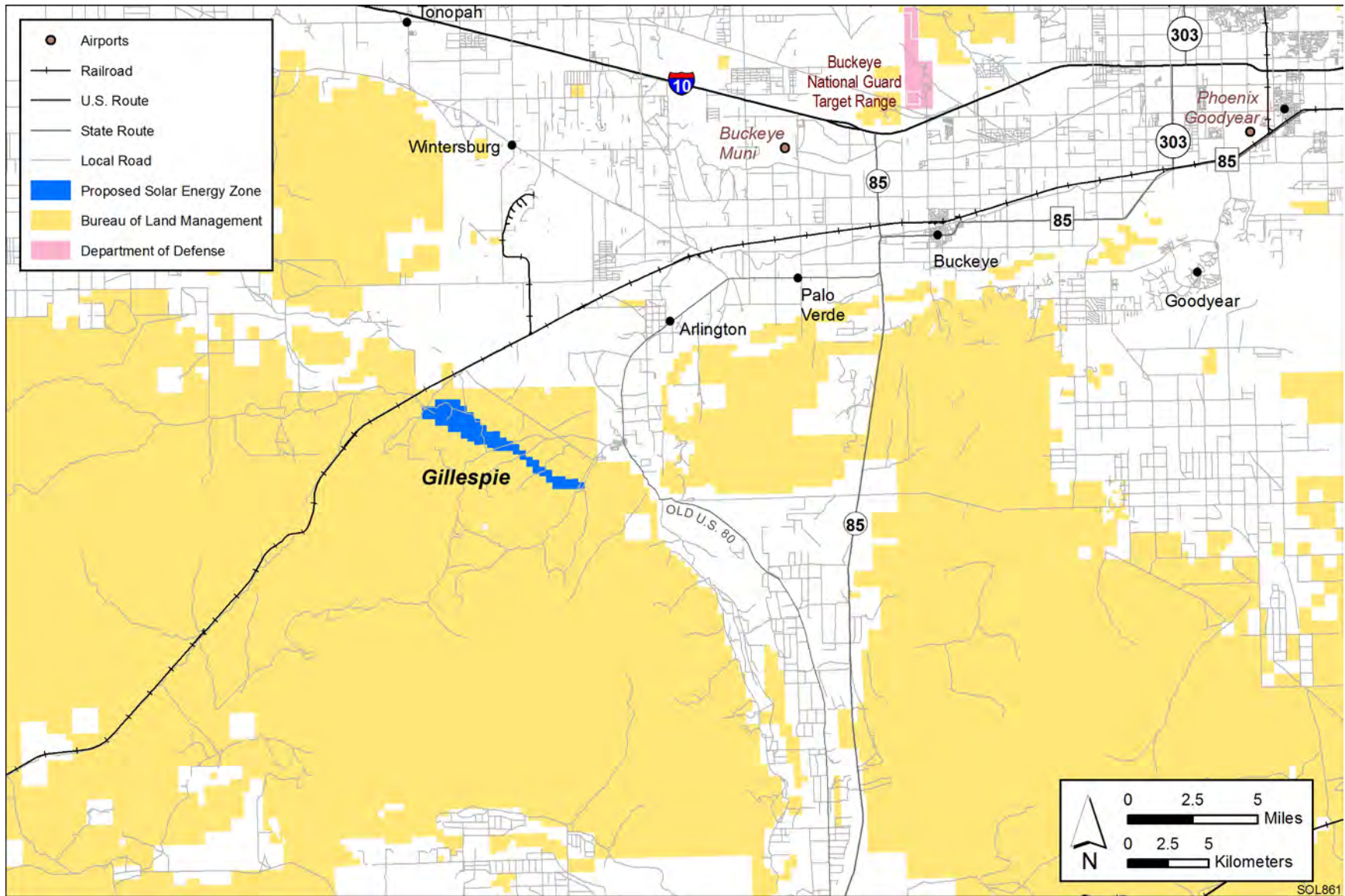
8
9 **8.3.21.1 Affected Environment**
10

11 The eastern tip of the Gillespie SEZ lies 3 mi (5 km) from the closest approach of Old
12 U.S. 80 and about 10 mi (16 km) from State Route 85, which runs in a general north–south
13 direction, as shown in Figure 8.3.21.1-1. However, the most direct, existing, driving route from
14 Old U.S. 80, at its closest approach to the SEZ, to State Route 85 would be either a 9-mi (14-km)
15 drive to the south and east along Old U.S. 80 to Galine Road (a dirt road) or a 15-mi (24-km)
16 drive to the north and east along Old U.S. 80. From Galine Road, State Route 85 travels 14 mi
17 (23 km) to the north, where it terminates at I-10; it travels 23 mi (37 km) to the south, where it
18 has a junction with I-8. Old U.S. 80 also travels to the south where it joins State Route 238 about
19 2 mi (3 km) north–northeast of the State Route 238 exit on I-8. One of the local unimproved dirt
20 roads that cross the SEZ is Agua Caliente Road, which runs west from Old U.S. 80 and crosses
21 the middle section of the SEZ from east to west and then travels northward in the SEZ. As listed
22 in Table 8.3.21.1-1, Old U.S. 80 carries an average traffic volume of about 900 to 1,000 vehicles
23 per day in the vicinity of the Gillespie SEZ (MCDOT 2010).
24

25 Data identifying open OHV routes within the proposed SEZ were not available. If such
26 routes are identified during project-specific analyses, the routes would be re-designated as closed
27 and alternative routes would be considered (see Section 5.5.1 for more details on how routes
28 coinciding with proposed solar facilities would be treated).
29

30 A branch of the UP Railroad passes along the northwestern edge of the Gillespie SEZ
31 at a distance of about 0.5 mi (0.8 km). The nearest railroad stop is in Buckeye to the northeast
32 (UP Railroad 2009), a drive of about 20 mi (30 km). The UP Railroad also has a stop in Gila
33 Bend to the south, just south of I-8 near its junction with Old U.S. 80 and State Route 85.
34

35 Five small airports and one major airport open to the public are within driving distance of
36 approximately 60 mi (97 km) of the proposed Gillespie SEZ, as listed in Table 8.3.21.1-2. There
37 are also more small municipal airports in the Phoenix metropolitan area at greater distances from
38 the SEZ. The nearest public airport is the Buckeye Municipal Airport, 20 mi (32 km) northeast
39 of the SEZ. None of the small airports has regularly scheduled passenger service. Phoenix Sky
40 Harbor International Airport is a major airport in Phoenix (59 mi [95 km]) to the northeast with
41 passenger service to most major cities in the United States provided by all major and some
42 regional U.S. carriers. Table 8.3.21.1-3 summarizes the commercial passenger and freight traffic
43 at those airports in the vicinity of the Gillespie SEZ.
44
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FIGURE 8.3.21.1-1 Local Transportation Network Serving the Proposed Gillespie SEZ

TABLE 8.3.21.1-1 AADT on Major Roads near the Proposed Gillespie SEZ for 2008

Road	General Direction	Location	AADT (Vehicles)
I-8	East-west	Exit 111 (Citrus Valley Rd.) to exit 115	10,500
		Exit 115 to exit 116 (State Route 85)	3,800
		Exit 116 (State Route 85) to exit 119 (Butterfield Trail)	4,100
I-10	East-west	Exit 103 (339th Ave.) to exit 109 (Palo Verde Rd.)	33,500
		Exit 109 (Palo Verde Rd. to exit 112 (State Route 85)	32,000
		Exit 112 (State Route 85) to exit 114 (Miller Rd.)	34,000
Old U.S. 80 ^a	East-west/north-south	Palo Verde Rd.	3,300
		Salome Highway	2,100
		Agua Caliente Rd.	930
		Patterson Rd.	1,000
		Woods Rd.	970
State Route 85	North-south	Gila Bend to Landfill Entrance Rd. (near Komatke Rd.)	8,700
		Landfill Entrance Rd. to Buckeye Rd. (E. Monroe Ave.)	11,500
		Buckeye Rd. (E. Monroe Ave.) to I-10 (exit 112)	12,500

^a Values presented are rounded average values taken from MCDOT (2010) that represent counts for only one or two days in each year that data was collected (2002 to 2009) at the stated locations and may reflect a seasonal and or day-of-the-week bias.

Source: ADOT (2010).

TABLE 8.3.21.1-2 Airports Open to the Public in the Vicinity of the Proposed Gillespie SEZ

Airport	Location	Owner/Operator	Runway 1			Runway 2		
			Length (ft [m])	Type	Condition	Length (ft [m])	Type	Condition
Buckeye Municipal	In Buckeye, 20 mi (32 km) northeast, south of I-10 exit 109 on S. Palo Verde Road	Town of Buckeye	5,500 (1,676)	Asphalt	Good	NA ^a	NA	NA
Gila Bend Municipal	In Gila Bend, 26 mi (42 km) south-southeast along State Route 85	Town of Gila Bend	5,200 (1,585)	Asphalt	Good	NA	NA	NA
Phoenix Goodyear	In Goodyear, 40 mi (64 km) northeast in the Phoenix metropolitan area	City of Phoenix	8,500 (2,591)	Asphalt	Good	NA	NA	NA
Glendale Municipal	In Glendale, 49 mi (79 km) northeast of the SEZ	City of Glendale	7,150 (2,179)	Asphalt	Good	NA	NA	NA
Phoenix Sky Harbor International	In Phoenix, 59 mi (95 km) east-northeast	City of Phoenix	7,800 (2,377)	Concrete/ grooved	Good	10,300 (3,139)	Concrete/ grooved	Good
			11,489 (3,502)	Concrete/ grooved	Good	NA	NA	NA
Wickenburg Municipal	In Wickenburg, 60 mi (97 km) north off U.S. 60	Town of Wickenburg	6,100 (1,859)	Asphalt	Good	NA	NA	NA

^a NA = not applicable.

Source: FAA (2010).

TABLE 8.3.21.1-3 Commercial Passenger and Freight Traffic at Airports in the Vicinity of the Proposed Gillespie SEZ for 2008

Airport	Passengers		Freight (lb [kg])	
	Arrived	Departed	Arrived	Departed
Glendale Municipal	76	109	0	0
Phoenix Sky Harbor International	19.5 million	19.5 million	292 million (132 million)	234 million (106 million)
Wickenburg Municipal	3	2	2,622 (1,189)	1,311 (595)

Source: BTS (2009).

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3 **8.3.21.2 Impacts**
4

5 As discussed in Section 5.19, the primary transportation impacts are anticipated to be
6 from commuting worker traffic. Single projects could involve up to 1,000 workers each day,
7 with an additional 2,000 vehicle trips per day (maximum). This volume of traffic on Old U.S. 80
8 would represent an increase in traffic of about 200% in the area of the Gillespie SEZ for a
9 project. Such traffic levels would represent about a 20% increase in the traffic levels experienced
10 on State Route 85 near the SEZ if all project traffic were to be routed through State Route 85.
11 Because higher traffic volumes would be experienced during shift changes, traffic on
12 Old U.S. 80 could experience moderate slowdowns during these time periods in the area of any
13 junctions with SEZ site access roads. Local road improvements, in addition to turn lanes, might
14 be necessary on any portion of Old U.S. 80 near any site access point(s).
15

16 Solar development within the SEZ would affect public access along OHV routes
17 designated open and available for public use. If there are any designated as open within the
18 proposed SEZ, open routes crossing areas granted ROWs for solar facilities would be
19 redesignated as closed (see Section 5.5.1 for more details on how routes coinciding with
20 proposed solar facilities would be treated).
21
22

23 **8.3.21.3 Specific Design Features and Design Feature Effectiveness**
24

25 No SEZ-specific design features have been identified related to impacts on transportation
26 systems around the proposed Gillespie SEZ. The programmatic design features described in
27 Appendix A, Section A.2.2, including local road improvements, multiple site access locations,
28 staggered work schedules, and ride-sharing, would all provide some relief to traffic congestion
29 on local roads leading to the site. Depending on the location of solar facilities within the SEZ,
30 more specific access locations and local road improvements could be implemented.
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1 **8.3.22 Cumulative Impacts**
2

3 The analysis presented in this section addresses the potential cumulative impacts in the
4 vicinity of the proposed Gillespie SEZ in Maricopa County, Arizona. The CEQ guidelines for
5 implementing NEPA define cumulative impacts as environmental impacts resulting from the
6 incremental impacts of an action when added to other past, present, and reasonably foreseeable
7 future actions (40 CFR 1508.7). The impacts of other actions are considered without regard to
8 the agency (federal or nonfederal), organization, or person that undertakes them. The time frame
9 of this cumulative impacts assessment could appropriately include activities that would occur up
10 to 20 years in the future (the general time frame for PEIS analyses), but little or no information is
11 available for projects that could occur further than 5 to 10 years in the future.
12

13 The land surrounding the proposed Gillespie SEZ is undeveloped with few permanent
14 residents living in the area. The nearest population centers are the small communities of
15 Arlington (population 470 in 2000) located about 7 mi (11 km) northeast of the SEZ, and
16 Wintersburg (population 2,966 in 2000) located about 10 mi (16 km) north of the SEZ. The
17 Gila Bend Reservation is located about 14 mi (22 km) south of the SEZ, there are also
18 reservations further to the east and southeast of the SEZ. The Buckeye National Guard Target
19 Range is located about 20 mi (32 km) northeast of the SEZ, the Barry M. Goldwater Air Force
20 Range is located about 22 mi (35 km) south, and the Luke Air Force Base is located about 30 mi
21 (48 km) northeast. The Kofa National Wildlife Refuge is located about 47 mi (75 km) west of
22 the SEZ.
23

24 The geographic extent of the cumulative impacts analysis for potentially affected
25 resources near the proposed Gillespie SEZ is identified in Section 8.3.22.1. An overview of
26 ongoing and reasonably foreseeable future actions is presented in Section 8.3.22.2. General
27 trends in population growth, energy demand, water availability, and climate change are
28 discussed in Section 8.3.22.3. Cumulative impacts for each resource area are discussed in
29 Section 8.3.22.4.
30
31

32 **8.3.22.1 Geographic Extent of the Cumulative Impacts Analysis**
33

34 The geographic extent of the cumulative impacts analysis for potentially affected
35 resources evaluated near the proposed Gillespie SEZ is provided in Table 8.3.22.1-1. These
36 geographic areas define the boundaries encompassing potentially affected resources. Their
37 extent may vary based on the nature of the resource being evaluated and the distance at which
38 an impact may occur (thus, for example, the evaluation of air quality may have a greater regional
39 extent of impact than visual resources). The BLM, the DoD, and the USFS administer most of
40 the land around the SEZ; there are also several Tribal lands east, southeast, and south of the
41 SEZ. The BLM administers approximately 43% of the lands within a 50-mi (80-km) radius of
42 the SEZ.
43
44

TABLE 8.3.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Gillespie SEZ

Resource Area	Geographic Extent
Land Use	Maricopa, La Paz, Yuma and Pinal Counties
Specially Designated Areas and Land with Wilderness Characteristics	Within a 25-mi (40-km) radius of the Gillespie SEZ
Rangeland Resources	
Grazing	Grazing allotments within 5 mi (8 km) of the Gillespie SEZ
Wild Horses and Burros	A 50-mi (80-km) radius from the center of the Gillespie SEZ
Recreation	Maricopa, La Paz, Yuma and Pinal Counties
Military and Civilian Aviation	Maricopa, La Paz, Yuma and Pinal Counties
Soil Resources	Areas within and adjacent to the Gillespie SEZ
Minerals	Maricopa, La Paz, Yuma and Pinal Counties
Water Resources	
Surface Water	Gila River, Centennial Wash
Groundwater	Lower Hassayampa groundwater basin
Air Quality and Climate	A 31-mi (50-km) radius from the center of the Gillespie SEZ
Vegetation, Wildlife and Aquatic Biota, Special Status Species	A 50-mi (80-km) radius from the center of the Gillespie SEZ, including portions of Maricopa, La Paz, Yuma and Pinal Counties in Arizona
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Gillespie SEZ
Acoustic Environment (noise)	Areas adjacent to the Gillespie SEZ
Paleontological Resources	Areas within and adjacent to the Gillespie SEZ
Cultural Resources	Areas within and adjacent to the Gillespie SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Gillespie SEZ for other properties, such as traditional cultural properties
Native American Concerns	Areas within and adjacent to the Gillespie SEZ; viewshed within a 25-mi (40-km) radius of the Gillespie SEZ
Socioeconomics	A 50-mi (80-km) radius from the center of the Gillespie SEZ
Environmental Justice	A 50-mi (80-km) radius from the center of the Gillespie SEZ
Transportation	U.S. Interstate Highways 8 and 10; Arizona State Highway 85.

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1 **8.3.22.2 Overview of Ongoing and Reasonably Foreseeable Future Actions**
2

3 The future actions described below are those that are “reasonably foreseeable;” that is,
4 they have already occurred, are ongoing, are funded for future implementation, or are included in
5 firm near-term plans. Types of proposals with firm near-term plans are as follows:
6

- 7 • Proposals for which NEPA documents are in preparation or finalized;
- 8
- 9 • Proposals in a detailed design phase;
- 10
- 11 • Proposals listed in formal NOIs published in the *Federal Register* or state
12 publications;
- 13
- 14 • Proposals for which enabling legislations has been passed; and
- 15
- 16 • Proposals that have been submitted to federal, state or county regulators to
17 begin a permitting process.
- 18

19 Projects in the bidding or research phase or that have been put on hold were not included
20 in the cumulative impact analysis.
21

22 The ongoing and reasonably foreseeable future actions described below are grouped
23 into two categories: (1) actions that relate to energy production and distribution, including
24 potential solar energy projects within 50 mi (80 km) of the proposed SEZ (Section 8.3.22.2.1);
25 and (2) other ongoing and reasonably foreseeable actions within this distance, including those
26 related to mining and mineral processing, grazing management, transportation, recreation, water
27 management, and conservation (Section 8.3.22.2.2). Together, these actions and trends have the
28 potential to affect human and environmental receptors within the geographic range of potential
29 impacts over the next 20 years.
30
31

32 **8.3.22.2.1 Energy Production and Distribution**
33

34 In November 2006, the Arizona Corporation Commission adopted final rules to expand
35 the state’s Renewable Energy Standard to 15% by 2025, with 30% of the renewable energy to
36 be derived from distributed energy (DSIRE 2010).
37

38 Reasonably foreseeable future actions related to renewable energy production and
39 energy distribution within 50 mi (80 km) of the proposed Gillespie SEZ are identified in
40 Table 8.3.22.2-1 and are described. One fast-track solar energy project has been identified, and
41 three other solar energy projects have been identified. No wind, geothermal, or major new
42 transmission projects are planned for the reasonably foreseeable future.
43
44

TABLE 8.3.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Gillespie SEZ^a

Description	Status	Resources Affected	Primary Impact Location
<i>Fast-Track Solar Energy Projects on BLM-Administered Land</i>			
Sonoran Solar Energy Project (AZA 034187), 375-MW CST/trough facility; 3,700 total acres	NOI to prepare an EIS issued on July 8, 2009	Land use, visual, terrestrial habitats, wildlife, groundwater	About 12 mi (19 km) east of Gillespie SEZ
<i>Other Solar Energy Projects</i>			
Mesquite Solar I; 150-MW PV facility	Construction to begin in 2011	Land use, visual, terrestrial habitats, wildlife	About 4 mi (6 km) northeast of the SEZ
Arlington Valley Solar I; 125 MW/trough or PV facility, 1100 acres	Construction to begin in 2010	Land use, visual, terrestrial habitats, wildlife	About 4 mi (6 km) north of the SEZ
Arlington Valley Solar II; 125 MW, 1100 acres	Construction to begin in 2010	Land use, visual, terrestrial habitats, wildlife	About 1 mi (2 km) north of the SEZ
<i>Transmission and Distribution Systems</i>			
None	NA ^a	NA	NA

^a NA = not applicable because no projects have been identified.

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Renewable Energy Development

Renewable energy ROW applications are considered in two categories, fast-track and regular-track applications. Fast-track applications, which apply principally to solar energy facilities, are those applications on BLM-administered lands for which the environmental review and public participation process is underway and the applications could be approved by December 2010. A fast-track project would be considered foreseeable because the permitting and environmental review processes would be under way. There is one fast-track project application within the ROI of the proposed Gillespie SEZ, the Sonoran Solar Energy Project (serial number AZA 034187). Regular-track proposals are considered potential future projects, but not necessarily foreseeable projects, since not all applications would be expected to be carried to completion. These proposals are considered together as a general level of interest in development of renewable energy in the region and are discussed in the following section.

Figure 8.3.22.2-1 shows the location of the fast-track solar energy project ROW application and 22 pending regular-track ROW applications within 50 mi (80 km) of the proposed Gillespie SEZ.

1 **Foreseeable Renewable Energy Projects**
2
3

4 **Sonoran Solar Energy Project.** This proposed fast-track project would be a parabolic
5 trough facility with an output of 375 MW, with options for natural gas backup and/or thermal
6 storage capabilities. The project site would be on BLM-administered land south of Buckeye,
7 Arizona, in the Little Rainbow Valley, about 12 mi (19 km) east of Gillespie SEZ. The proposed
8 facility would occupy approximately 3,700 acres (15.0 km²). The facility is expected to operate
9 for approximately 30 years and would connect to the electrical grid at the existing Jojoba
10 Substation using a newly-constructed, 3-4 mi (5-6 km), 500-kV tie-line. Once operational, the
11 total water demand for the facility would be 2,305 to 3,003 ac-ft/yr in an average year. About
12 870 workers would be employed during the construction of the facility (peaking at about
13 1,500 workers), and 82 full-time employees would be required for operations. The Final EIS
14 for the Sonoran Solar Energy Project will be released in October 2010 (BLM 2010b,c).
15
16

17 **Mesquite Solar 1.** Sempra Generation intends to construct a PV solar power plant 5 mi
18 (8 km) west of Arlington, Arizona, 4 mi (6 km) north of the SEZ, and adjacent to the existing
19 combined-cycle Mesquite Power Generating Station. The first phase will produce 150 MW, and
20 the site has sufficient land to build up to 600 MW of solar power. Construction is expected to
21 begin in 2011, and will employ about 300 construction workers and 10 operational workers
22 (Sempra Generation 2010a).
23
24

25 **Arlington Valley Solar Energy Projects (AVSE) I and II.** LS Power intends to construct
26 two 125-MW solar power plants. AVSE I will be located about 6 mi (10 km) west of Arlington,
27 Arizona, and 4 mi (6 km) north of the SEZ. AVSE II will be located about 6 mi (10 km) west of
28 Arlington, Arizona, and about 1 mi (2 km) north of the SEZ. Both sites will occupy a total of
29 2,200 acres (8.9 km²). The facilities will utilize either parabolic or PV technology, and each will
30 employ 400 construction workers and 40 operational workers. Construction is expected to start in
31 2010 (AVSE 2009).
32
33

34 **Pending Solar Applications on BLM-Administered Lands.** In addition to the fast-track
35 solar project described above, a number of regular track ROW applications for solar projects
36 have been submitted to the BLM that would be located within 50 mi (80 km) of the SEZ.
37 Table 8.3.22.2-2 provides a list of all solar projects that had pending ROW applications
38 submitted to BLM as of March 2010 (BLM and USFS 2010b). Figure 8.3.22.2-1 shows the
39 locations of these applications. There are no pending wind or geothermal ROW applications
40 within this distance.
41

42 Within 50 mi (80 km) of the proposed Gillespie SEZ, there are 22 active solar
43 applications. The likelihood of any of the regular-track application projects actually being
44 developed is uncertain but is generally assumed to be less than that for fast-track applications.
45 The projects are all listed in Table 8.3.22.2-2 for completeness and as an indication of the level
46 of interest in development of solar energy in the region. Some number of these applications

TABLE 8.3.22.2-2 Pending Renewable Energy Project ROW Applications on BLM-Administered Land within 50 mi (80 km) of the Proposed Gillespie SEZ^a

Serial No.	Project Name	Application Received	Size (acres ^b)	MW	Technology	Status (NOI date)	Field Office
<i>Solar Applications</i>							
AZA 034184	Boulevard Assoc., LLC (Aguila)	June 26, 2007	7,375	500	CSP/trough	Pending	Hassayampa
AZA 034186	Boulevard Assoc., LLC (Big Horn)	June 26, 2007	6,232	500	CSP/trough	Pending	Hassayampa
AZA 034187	Nextera/Boulevard Assoc., LLC (Sonoran Solar)	June 28, 2007	4,000	375	CSP/trough	Pending	Lower Sonoran
AZA 034321	Ausra AZ II, LLC (Palo Verde)	Oct. 1, 2007	5,748	840	CSP/CLFR	Pending	Hassayampa
AZA 034357	First Solar (Gila Bend)	Nov. 6, 2007	6,003	500	PV	Pending	Lower Sonoran
AZA 034358	First Solar (Saddle Mtn)	Nov. 6, 2007	5,997	300	PV	Pending	Lower Sonoran
AZA 034416	Pacific Solar Invst., Inc. (Iberdrola) (Eagle Trail)	Dec. 2, 2007	19,000	1,500	CSP/trough	Pending	Yuma
AZA 034424	Pacific Solar Invst., Inc. (Iberdrola) (Big Horn)	Dec. 4, 2007	13,440	900	CSP	Pending	Hassayampa
AZA 034425	Pacific Solar Invst., Inc. (Iberdrola) (Hyder)	Dec. 7, 2007	5,794	300	CSP/trough	Pending	Lower Sonoran; Yuma
AZA 034426	Pacific Solar Invst., Inc. (Iberdrola) (Ranegras)	Dec. 2, 2007	25,860	2,000	CSP/trough	Pending	Yuma
AZA 034540	Horizon Wind Energy, LLC (Aguila)	March 4, 2008	11,535	250	CSP/trough	Pending	Hassayampa
AZA 034560	Nextlight Renewable Power, LLC	March 26, 2008	15,040	500	CSP/trough	Pending	Yuma
AZA 034566	Nextlight Renewable Power, LLC	March 26, 2008	13,428	500	CSP/trough	Pending	Yuma
AZA 034568	Nextlight Renewable Power, LLC (Palomas)	March 26, 2008	20,165	500	CSP/trough	Pending	Yuma
AZA 034665	Solarreserve, LLC (Black Rack Hill)	May 27, 2008	5,600	600	CSP/tower	Pending	Yuma
AZA 034668	Solarreserve, LLC (Agua Caliente)	May 27, 2008	5,678	600	CSP/tower	Pending	Yuma
AZA 034737	Arizona Solar Invst., Inc. (Haraqahala)	July 10, 2008	14,047	500	CSP/trough	Pending	Hassayampa
AZA 034739	IDIT, Inc.	July 9, 2008	15,000	1,000	CSP/trough	Pending	Yuma
AZA 034754	Horizon Wind Energy, LLC	March 4, 2008	28,760	250	CSP/trough	Pending	Lake Havasu
AZA 034774	Arizona Solar Invst., Inc. (Dendora Valley)	Aug. 12, 2008	14,765	500	CSP/trough	Pending	Lower Sonoran
AZA 034797	LSR Jackrabbit, LLC (Jackrabbit)	Aug. 27, 2008	27,036	500	CSP/tower	Pending	Hassayampa
AZA 034799	LSR Palo Verde, LLC (Palo Verde)	Aug. 27, 2008	5,855	600	CSP/trough	Pending	Lower Sonoran
AZA 035166	IDIT, Inc. (Arlington West)	July 27, 2009	5,800	–	PV	Pending	Lower Sonoran

^a Total 22 Solar acres = 421,268; Total Solar MW = 20,658.

^b To convert acres to km², multiply by 0.004047.

1 would be expected to result in actual projects. Thus, the cumulative impacts of these potential
 2 projects are analyzed in their aggregate effects.

3
 4
 5 **8.3.22.2.2 Other Actions**

6
 7 Other major ongoing and foreseeable actions identified within 50 mi (80 km) of the
 8 proposed Gillespie SEZ are listed in Table 8.3.22.2-3 and are described in the following
 9 subsections.

10
 11 **TABLE 8.3.22.2-3 Other Major Actions near the Proposed Gillespie SEZ^a**

Description	Status	Resources Affected	Primary Impact Location
Palo Verde–Devers 500-kV Transmission Line	Operating		Corridor passes 6 mi (10 km) north of the SEZ
Palo Verde Nuclear Generating Station	Operating since 1986		6 mi (10 km) north of the SEZ
Redhawk Power Station	Operating		3 mi (6 km) north of the SEZ
West Phoenix Power Station	Operating since 1930		40 mi (64 km) east of the SEZ
Agua Fria Generating Station	Operating since 1968		40 mi (64 km) east of the SEZ
Kyrene Generating Station	Operating since 1951		45 mi (72 km) from the SEZ
Mesquite Power Generating Station	Operating since 2003		4 mi (6 km) north of the SEZ
Arlington Valley Energy Facility	Operating since 2002		4 mi (6 km) north of the SEZ
Harquahala Generating Project	Operating since 2004		14 mi (22 km) north of the SEZ
Impact Area Expansion Yuma Proving Ground	EA March 2010	Terrestrial habitat, wildlife	Boundary about 30 mi (48 km) south and southwest
Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National Wildlife Refuge	EA December 2009	Wildlife	Boundary 48 mi (77 km) west of the SEZ
Proposed Range Enhancements at Barry M. Goldwater Range East	DEIS July 2009		Boundary 22 mi (35 km) south of the SEZ
Beddown of Training F-35A Aircraft	NOI Dec. 28, 2009		35 mi (56 km) northeast of the SEZ

^a Projects operating or in latter stages of agency environmental review and project development.

1 **Other Ongoing Actions**
2
3

4 ***Palo Verde–Devers 500-kV Transmission Line.*** The existing Palo Verde–Devers 500-kV
5 transmission line route connects the Palo Verde Nuclear Generating Station with the Devers
6 Substation in California west of Palm Springs. This line is about 6 mi (10 km) north of the
7 Gillespie SEZ at its nearest point.
8
9

10 ***Palo Verde Nuclear Generating Station.*** Arizona Public Service (APS) operates the Palo
11 Verde Nuclear Generating Station on a 4,280-acre (17-km²) site located 55 mi (88 km) west of
12 Phoenix Arizona and 6 mi (10 km) north of the SEZ. The power plant contains three pressurized-
13 water reactors with a net capacity of 3,872 MW, and has operated since 1986. Nine mechanical-
14 draft cooling towers utilize treated sewage water from the city of Phoenix. The plant employs
15 approximately 2,500 workers (DOE 2009b; NRC 2009).
16
17

18 ***Redhawk Power Station.*** APS operates the Redhawk Power Station, located 3 mi (5 km)
19 west of Arlington, Arizona and approximately 3 mi (5 km) north of the SEZ. The plant is
20 comprised of two combined cycle natural gas-fired units that produce a total of 1,060 MW. The
21 cooling system utilizes treated sewage water from the city of Phoenix.
22
23

24 ***West Phoenix Power Station.*** APS operates the West Phoenix Power Station, located in
25 southwest Phoenix approximately 40 mi (64 km) east of the SEZ. The station began operation
26 in 1930 with an 18-MW generator. The plant now consists of five combined-cycle and two
27 combustion turbine units with a total capacity of about 1,000 MW (South Phoenix Industry
28 Challenge 2010).
29
30

31 ***Agua Fria Generating Station.*** The Salt River Project (SRP) operates the Agua Fria
32 Generating Station in Peoria, Arizona, about 40 mi (64 km) east of the SEZ. Unit 2 initially
33 began operation in 1958 and five other units were added by 1975. The station can burn either
34 oil or natural gas, and has a capacity of 626 MW (SRP 2010).
35
36

37 ***Kyrene Generating Station.*** SRP operates the Kyrene Generating Station in Tempe
38 Arizona, about 45 mi (72 km) east of the SEZ. The first unit was completed in 1951 and five
39 other units were added, the last in 1996. Capacities are 106 MW from the two original steam
40 units, 165 MW from three combustion turbine units, and 250 MW from one combined-cycle
41 unit. The station can burn either oil or natural gas (SRP 2010).
42
43

44 ***Mesquite Power Generating Station.*** Sempra Generation operates the Mesquite Power
45 Generating Station on a 400-acre (1.6-km²) site located about 5 mi (8 km) west of Arlington,
46 Arizona, and 4 mi (6 km) north of the SEZ. The plant is comprised of two combined-cycle

1 natural gas-fired units that produce a total of 1,250 MW. The plant, which began operating in
2 2003, employs 33 full-time workers (Sempra Generation 2010b).

3
4
5 ***Arlington Valley Energy Facility.*** LS Power operates the Arlington Valley Energy
6 facility on a site located about 6 mi (10 km) west of Arlington, Arizona, and about 4 mi (6 km)
7 north of the SEZ. The facility, which began operating in 2002, is a three-unit, combined-cycle
8 gas-fired plant that produces 570 MW (LS Power 2010).

9
10
11 ***Harquahala Generating Project.*** New Harquahala Generating Company operates the
12 Harquahala Generating Project on a site located near Tonopah Arizona and about 14 mi (22 km)
13 north of the SEZ. The plant is comprised of three combined-cycle, natural gas-fired units that
14 produce a total of 1,060 MW. The plant, which began operating in 2004, utilizes two
15 mechanical-draft cooling towers (NHGC, LLC 2007).

16 17 18 **Other Foreseeable Actions**

19
20
21 ***Impact Area Expansion Yuma Proving Ground.*** The Yuma Proving Ground
22 encompasses about 840,000 acres (3,350 km²). The closest boundary to the SEZ is about 43 mi
23 (69 km) to the south and southwest. The Kota Region, 374,605 acres (1,516 km²) has been
24 heavily contaminated from munitions testing since the early 1950. This contamination consists
25 of artillery, mortars, mines, mine detection systems, rockets, demolition tools, aerial guided/
26 unguided bombs, radar sensors, sensor fuzed munitions, guided munitions, Electromagnetic
27 Gun, Jammers, Improvised Explosive Devices, missiles, tank ammunition, small arms, lasers,
28 target evaluation and emplacement. The Army is proposing to expand the existing designated
29 impact areas in the Kofa Region. The proposed impact areas would encompass approximately
30 80,000 acres (325 km²) (United States Army 2010).

31
32
33 ***Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National***
34 ***Wildlife Refuge.*** The Fish and Wildlife Service proposes to limit predation by mountain lions
35 on desert bighorn sheep in the Kofa National Wildlife Refuge, whose boundary is about 48 mi
36 (77 km) west of the SEZ. This would include removal of “offending” mountain lions by either
37 lethal means or through translocation. An offending mountain lion is defined as one that has
38 killed two or more desert bighorn sheep within a six-month period (USFWS 2009b).

39
40
41 ***Proposed Range Enhancements at Barry M. Goldwater Range East.*** The Barry M.
42 Goldwater Range (BMGR) encompasses 1.9 million acres (7,700 km²). The closest boundary,
43 the eastern portion of the BMGR is about 22 mi (35 km) south of the SEZ. Military pilots use the
44 range to practice air-to-air maneuvers and engage simulated battlefield targets on the ground.
45 The U. S. Air Force (USAF) is proposing to upgrade and improve the training assets and
46 opportunities at BMGR East (USAF 2009a, 2010a).

1 ***Beddown of Training F-35A Aircraft at Luke Air Force Base.*** Luke Air Force Base is
2 located about 18 mi (29 km) northwest of downtown Phoenix and 35 mi (56 km) northeast of
3 the SEZ. It is the only active-duty F-16 training base for more than 160 F-16 aircraft. The base
4 population consists of 5900 military and 15,000 family members. More than 400 pilots graduate
5 every year and receive combat assignments throughout the world. The USAF is proposing the
6 beddown of training F-35A Aircraft at Luke Air Force Base. An Environmental Impact
7 Statement is being prepared, and Luke Air Force Base is the preferred site among the other
8 alternatives (USAF 2009b, 2010b,c).

9
10
11 **Grazing Allotments**

12
13 Four grazing allotments overlap Gillespie SEZ: the Gable-Ming, A Lazy T, Layton, and
14 Jagow-Kreager allotments. Within 50 mi (80 km) of the SEZ, most of the land is covered with
15 grazing allotments with the exception of the land to the northeast and to the south at a distance
16 of 30 to 50 mi (48 to 80 km).

17
18
19 **Mining**

20
21 The BLM GeoCommunicator database (BLM and USFS 2010b) shows several active
22 mining claims on file with BLM. The highest density (51 to 100 claims) is located about 10 mi
23 (16 km) south, 12 mi (19 km) east, and 40 to 50 mi (64 to 80 km) northwest and northeast of the
24 Gillespie SEZ.

25
26
27 **8.3.22.3 General Trends**

28
29
30 ***8.3.22.3.1 Population Growth***

31
32 Maricopa County, the only county defining the ROI, experienced a population growth
33 rate of 3.2% from 2000 to 2008 (see Section 8.3.19.1.5). The population of the Maricopa County
34 in 2008 was 3,958,263. The growth rate for the state of Arizona as a whole was 3.0%.

35
36
37 ***8.3.22.3.2 Energy Demand***

38
39 The growth in energy demand is related to population growth through increases in
40 housing, commercial floorspace, transportation, manufacturing, and services. Given that
41 population growth is expected in Maricopa County between 2006 and 2016, an increase in
42 energy demand is also expected. However, the Energy Information Administration (EIA)
43 projects a decline in per-capita energy use through 2030, mainly because of the high cost of
44 oil and improvements in energy efficiency throughout the projection period. Primary energy
45 consumption in the United States between 2007 and 2030 is expected to grow by about
46 0.5% each year; the fastest growth is projected for the commercial sector (at 1.1% each year).

1 Transportation, residential, and industrial energy consumption are expected to grow by about
2 0.5, 0.4, and 0.1% each year, respectively (EIA 2009).

3 4 5 **8.3.22.3.3 Water Availability**

6
7 As described in Section 8.3.9.1, within the Lower Hassayampa basin, pre-disturbance
8 groundwater inflow was estimated to be 32,000 ac-ft/year (39 million m³/yr) (Freethy and
9 Anderson 1986). However, inflows to the basin are currently much less. Most of the
10 pre-disturbance inflows to the Lower Hassayampa were from adjacent groundwater basins, and
11 these basins are now in overdraft such that only a small amount of groundwater is flowing into
12 the adjacent Lower Hassayampa basin (ADWR 1999).

13
14 Pumping groundwater for agricultural purposes in the Lower Hassayampa basin
15 reportedly began in the early 1950s (ADWR 1999). Between the 1950s and 1998, water levels
16 declined by up to 90 ft in the Lower Hassayampa basin (ADWR 1999). In 1998, a large cone of
17 depression was present in the Lower Hassayampa basin due to continued agricultural pumping
18 (ADWR 1999). Land subsidence was measured to be occurring at a rate of up to 0.8 in./yr
19 (2 cm/yr) between 2006 and 2008, primarily in the agricultural areas along the Gila River and
20 near the town of Buckeye (ADWR 2010b).

21
22 In 2005, water withdrawals from surface waters and groundwater in Maricopa County
23 were 1.58 million ac-ft/yr (1.95 billion m³/yr), of which 16% came from surface waters and 84%
24 came from groundwater. The largest water use category was agriculture, at 1.27 million ac-ft/yr
25 (1.57 billion m³/yr). Thermoelectric water uses accounted for 26,400 ac-ft/yr
26 (32.6 million m³/yr), with public supply, municipal, and industrial water uses on the order of
27 25,800 ac-ft/yr (31.8 million m³/yr), 7,800 ac-ft/yr (9.6 million m³/yr), and 6,200 ac-ft/yr
28 (7.6 million m³/yr), respectively (Kenny et al. 2009).

29 30 31 **8.3.22.3.4 Climate Change**

32
33 A report on global climate change in the United States prepared by the U.S. Global
34 Research Program (GRCP 2009) documents current temperature and precipitation conditions
35 and historic trends. Excerpts of the conclusions from this report indicate the following for the
36 Southwest region of the United States, which includes Arizona:

- 37
38
- 39 • Decreased precipitation, with a greater percentage of that precipitation coming
40 from rain, will result in a greater likelihood of winter and spring flooding and
41 decreased stream flow in the summer.
 - 42 • Increased frequency and altered timing of flooding. For example, winter
43 precipitation in Arizona is already becoming more variable, with a trend
44 toward both more frequent extremely dry and extremely wet winters.
- 45

- 1 • The average temperature in the southwest has already increased by about
2 1.5 °F (0.8 °C) compared to a 1960 to 1979 baseline, and by the end of the
3 century, the average annual temperature is projected to rise 4 °F to 10 °F
4 (2 °C to (6 °C).
5
- 6 • A warming climate and the related reduction in spring snowpack and soil
7 moisture have increased the length of the wildfire season and intensity of
8 forest fires.
9
- 10 • Later snow and less snow coverage in ski resort areas could force ski areas
11 to shut down before the season would otherwise end.
12
- 13 • Much of the Southwest has experienced drought conditions since 1999. This
14 represents the most severe drought in the last 110 years. Projections indicate
15 an increasing probability of drought in the region.
16
- 17 • As temperatures rise, the landscape will be altered as species shift their ranges
18 northward and upward to cooler climates.
19
- 20 • Temperature increases, when combined with urban heat island effects for
21 major cities such as Phoenix, present significant stress to health and electricity
22 and water supplies.
23
- 24 • Increased minimum temperatures and warmer springs extend the range and
25 lifetime of many pests that stress trees and crops, and lead to northward
26 migration of weed species.
27
28

29 **8.3.22.4 Cumulative Impacts on Resources**

30
31 This section addresses potential cumulative impacts in the proposed Gillespie SEZ on
32 the basis of the following assumptions: (1) because of the small size of the proposed SEZ
33 (<10,000 acres [$<40.5 \text{ km}^2$]), only one project would be constructed at a time, and (2) maximum
34 total disturbance over 20 years would be about 2,094 acres (8.5 km^2) (80% of the entire
35 proposed SEZ). For this analysis, it is also assumed that this total maximum disturbance area
36 would be disturbed in a single year and up to 250 acres (1.01 km^2) monthly on the basis of
37 construction schedules planned in current applications. It is also assumed that no new
38 transmission line would need to be constructed to connect to the regional grid, since a 500 kV
39 line runs adjacent to the SEZ. Regarding site access, the nearest major road is Old U.S. 80,
40 which runs just east of the SEZ. It is assumed that 3 mi (5 km) of new access road disturbing
41 an additional 22 acres (0.09 km^2) would need to be constructed to reach this road and to support
42 solar development in the SEZ.
43

44 Cumulative impacts that would result from the construction, operation, and
45 decommissioning of solar energy development projects within the proposed SEZ when added
46 to other past, present, and reasonably foreseeable future actions described in the previous

1 section in each resource area are discussed below. At this stage of development, because of the
2 uncertain nature of future projects in terms of size, number, and location within the proposed
3 SEZ, and the types of technology that would be employed, the impacts are discussed
4 qualitatively or semiquantitatively, with ranges given as appropriate. More detailed analyses
5 of cumulative impacts would be performed in the environmental reviews for the specific
6 projects in relation to all other existing and proposed projects in the geographic area.
7
8

9 **8.3.22.4.1 Lands and Realty**

10
11 The area covered by the proposed Gillespie SEZ is largely rural and undeveloped. The
12 areas surrounding the SEZ are both rural and industrial in nature, with several large electric
13 power plants nearby. Old U.S. 80, which runs about 3 mi (5 km) east of the SEZ, would provide
14 access to the southern portion of the SEZ, while unpaved Agua Caliente Road crosses the SEZ
15 (Section 8.3.2.1).
16

17 Development of the SEZ for utility-scale solar energy production would establish a new
18 industrial area that would exclude many existing and potential uses of the land, perhaps in
19 perpetuity. Since the area already includes several large developments, including the Palo Verde
20 Nuclear Generating Station and two large capacity transmission lines, utility-scale solar energy
21 development within the SEZ would not be a new land use in the area, but would convert
22 additional rural land to such use. Access to portions of the SEZ holding solar facilities by both
23 the general public and much wildlife for current uses would be eliminated.
24

25 As shown in Table 8.3.22.2-2 and Figure 8.3.22.2-1, there is one fast-track solar
26 application and 22 other pending solar applications on BLM-administered lands within a 50-mi
27 (80-km) radius of the proposed Gillespie SEZ. There are currently no wind or geothermal
28 applications within this distance and no solar applications within the SEZ. The Sonoran
29 Solar Energy Project fast-track solar application lies about 12 mi (19 km) east of the SEZ.
30 The large number of pending solar energy applications indicates strong interest in solar energy
31 development within the geographic extent of effects of the proposed SEZ, but only the fast-track
32 solar application is considered a firmly foreseeable development (Section 8.3.22.2.1).
33

34 The other foreseeable projects on private land identified in Section 8.3.22.2.2 are few in
35 number and are located at least 22 mi (35 km) from the SEZ (Section 8.3.22.2.2) and would have
36 minimal impacts on land use near the SEZ.
37

38 The development of utility-scale solar projects in the proposed Gillespie SEZ in
39 combination with other ongoing, foreseeable, and potential actions within the 50-mi (80-km)
40 geographic extent of effects could have cumulative effects on land use. Ongoing, foreseeable,
41 and potential actions on and near the SEZ could result in small cumulative impacts on land use
42 through impacts on land access and use for other purposes, on groundwater availability, and on
43 visual resources, especially if the SEZ is fully developed with solar facilities. Cumulative
44 impacts on land use could rise to moderate if a major portion of the pending solar applications in
45 the region were to result in actual projects, but projects within the SEZ would make only a small
46 contribution to cumulative impacts because of its relatively small size.

1 **8.3.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics**
2

3 There are ten specially designated areas within 25 mi (40 km) of the proposed Gillespie
4 SEZ in Arizona that potentially could be affected by solar energy development within the SEZ.
5 Portions of three of these areas lie within 5 mi (8 km) of the SEZ (Section 8.3.3.1). Potential
6 exists for cumulative visual impacts on these areas from the construction of utility-scale solar
7 energy facilities within the SEZ and outside the SEZ within the geographic extent of effects and
8 from the construction of transmission lines and roads outside the SEZ that would serve both.
9 The exact nature of cumulative visual impacts on the users of these areas would depend on the
10 specific solar technologies employed and the locations of solar facilities, transmission lines, and
11 roads actually built within and outside the SEZ. One fast-track solar project and about
12 11 pending solar applications lie within 25 mi (40 km) of the proposed SEZ (Figure 8.3.22.2-1),
13 some of which, if built, would affect some of the same sensitive areas as facilities built within
14 the SEZ. Such effects could include visual impacts, wilderness characteristics, reduced
15 accessibility, and ecological effects.
16

17
18 **8.3.22.4.3 Rangeland Resources**
19

20 The proposed Gillespie SEZ includes small portions of three ephemeral grazing
21 allotments and one perennial allotment (Section 8.3.4.1.1). If utility-scale solar facilities were
22 constructed on the SEZ, those areas occupied by the solar projects would be excluded from
23 grazing. The development of other potential solar energy projects within 50 mi (80 km) of the
24 SEZ could result in cumulative impacts on grazing due to the number and relative proximity of
25 several of the proposed facilities to the SEZ. However, the contribution of such effects from
26 projects within the SEZ would be minimal due to the small area affected.
27

28 The proposed Gillespie SEZ is about 47 mi (76 km) from the nearest wild horse and
29 burro HMA managed by BLM and more than 50 mi (80 km) from any wild horse and burro
30 territories administered by the USFS, thus solar energy development within the SEZ would not
31 directly or indirectly affect wild horses and burros (Section 8.3.4.2.2). The SEZ would not,
32 therefore, contribute to cumulative effects on wild horses and burros.
33

34
35 **8.3.22.4.4 Recreation**
36

37 Due to its small size, limited outdoor recreation occurs in the area of the proposed SEZ.
38 The Agua Caliente Road, which passes through the SEZ, provides access to old mines, livestock
39 facilities, and to the Signal Mountain and Woolsey Peak WAs within and outside of the SEZ
40 (Section 8.3.5.1). Construction of utility-scale solar projects on the SEZ would preclude
41 recreational use of the affected lands for the duration of the projects, while access restrictions
42 within the SEZ would affect access to recreational areas within and outside the SEZ. Such effects
43 are expected to be small due to low current use and alternate access routes. Foreseeable and
44 potential actions, mainly one fast-track and 22 pending solar applications, would have similar
45 small effects on current recreational activities individually. Small cumulative impacts on
46 recreation within the geographic extent of effects might be possible from the aggregate presence

1 of several new solar facilities within the area if a large number of projects with pending
2 applications are ultimately built.

3 4 5 **8.3.22.4.5 Military and Civilian Aviation**

6
7 The entire proposed SEZ is covered by an MTR with 300-ft (91-m) AGL operating
8 limits, while the SEZ is located 33 mi (92 km) southwest of Luke Air Force Base and is located
9 within an extensive web of MTRs and SUAs (Section 8.3.6.1). The military has indicated that
10 construction of solar or transmission facilities in excess of 250 ft (76 m) tall would adversely
11 affect the use of the MTR (Section 8.3.6.2). Potential new solar facilities and associated new
12 transmission lines outside the SEZ could present additional concerns for military aviation,
13 depending on the eventual location of such facilities with respect to training routes, and thus
14 could result in cumulative impacts on military aviation. The closest civilian airports in Buckeye
15 and Gila Bend located 15 mi (42 km) northeast and 20 mi (32 km) south-southeast, respectively,
16 of the SEZ are likely too far away to be affected by developments in the SEZ.

17 18 19 **8.3.22.4.6 Soil Resources**

20
21 Ground-disturbing activities (e.g., grading, excavating, and drilling) during the
22 construction phase of a solar project, including the construction of any associated transmission
23 line connections and new roads, would contribute to soil loss due to wind erosion. Road use
24 during construction, operations, and decommissioning of the solar facilities would further
25 contribute to soil loss. Programmatic design features would be employed to minimize erosion
26 and loss. Residual soil losses with these mitigations in place would be in addition to losses from
27 construction of the fast-track Sonoran Solar Energy Project, other potential solar energy
28 facilities, and other ongoing activities, including electric power generation, and agriculture.
29 Cumulative impacts on soil resources from other foreseeable projects within the region are
30 unlikely as these projects are all more than 20 mi (32 km) from the SEZ (Section 8.3.22.2.2).
31 Potential new solar facilities outside the SEZ would contribute incremental impacts on soil
32 erosion, the extent of which would depend on the number and location of facilities actually built.
33 Cumulative impacts, including from any development in the SEZ, would be small with required
34 design features in place.

35
36 Landscaping of solar energy facility areas in the SEZ could alter drainage patterns and
37 lead to increased siltation of surface water streambeds, in addition to that from other potential
38 solar projects and other activities outside the SEZ. However, with the required design features in
39 place, cumulative impacts would likewise be small.

40 41 42 **8.3.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)**

43
44 As discussed in Section 8.3.8, there are currently no active oil and gas leases within the
45 proposed Gillespie SEZ, and there are proposals for geothermal energy development pending.
46 There are, however, 6 placer mining claims in the very northern portion of the SEZ on about

1 210 acres (0.8 km²). Because of the generally low level of mineral production in the proposed
2 SEZ and surrounding area and the expected low impact on mineral accessibility of other
3 foreseeable actions within the geographic extent of effects, no cumulative impacts on mineral
4 resources are expected.

7 **8.3.22.4.8 Water Resources**

9 Section 8.3.9.2 describes the water requirements for various technologies if they were
10 to be employed on the proposed SEZ to develop utility-scale solar energy facilities. The amount
11 of water needed during the peak construction year for all evaluated solar technologies would
12 be about 1,300 ac-ft/yr (1.6 million m³/yr). During operations, with full development of the
13 SEZ over 80% of its available land area, the amount of water needed for all evaluated solar
14 technologies would range from 12 to 6,289 ac-ft/yr (15,000 to 7.8 million m³/yr). The amount of
15 water needed during decommissioning would be similar to or less than the amount used during
16 construction. As discussed in Section 8.3.22.3.3, water withdrawals in 2005 from surface waters
17 and groundwater in Maricopa County were 1.58 million ac-ft/yr (1.95 billion m³/yr), of which 16
18 % came from surface waters and 84% came from groundwater. The largest water use category
19 was agriculture, at 1.27 million ac-ft/yr (1.57 billion m³/yr). Therefore, cumulatively the
20 additional water resources needed for solar facilities in the SEZ during operations would
21 constitute from a relatively very small (0.0009%) to a small (0.5%) increment (the ratio of the
22 annual water requirement for operations to the annual amount withdrawn in Maricopa County),
23 depending on the solar technology used (PV technology at the low end and the wet-cooled
24 parabolic trough technology at the high end). As discussed in Section 8.3.9.1.3, the proposed
25 Gillespie SEZ is located within the Lower Hassayampa subbasin of the Phoenix AMA basin. The
26 Phoenix AMA has an estimated annual natural recharge of 24,200 ac-ft (29.8 million m³). Thus,
27 solar developments on the SEZ would have the capacity to use up to 26% of estimates of the
28 larger Phoenix AMA basin recharge using wet-cooling, while full development with dry-cooled
29 solar trough technologies could require up to 634 ac-ft/yr (0.78 million m³/yr)
30 (Section 8.3.9.2.2), or 2.6% of estimated recharge in the Phoenix AMA basin.

31
32 While solar development of the proposed SEZ with water-intensive technologies that
33 would use groundwater might be judged infeasible due to concerns for groundwater supplies, if
34 employed, intensive groundwater withdrawals could cause drawdown of groundwater, further
35 land subsidence, and disturbance of regional groundwater flow patterns and recharge patterns,
36 potentially affecting ecological habitats (Section 8.3.9.2). Cumulative impacts on groundwater
37 could occur when combined with other future developments in the region. The proposed fast-
38 track Sonoran Solar Energy Project would be located about 12 mi (19 km) east of the SEZ
39 and would use up to 3,000 ac-ft/yr (3.7 million m³) of groundwater from the Rainbow Valley
40 groundwater basin (BLM 2010c). While the Rainbow Valley basin is also a subbasin of the
41 Phoenix AMA, withdrawals from this basin would not likely contribute to groundwater
42 drawdown in the Lower Hassayampa groundwater where the SEZ is located. However, one or
43 more of the other 22 pending solar applications within 50 mi (80 km) of the proposed SEZ
44 (Section 8.3.22.2.1), if built, could contribute to cumulative effects on groundwater supplies
45 in the Lower Hassayampa basin or other basins and on associated surface ecological habitats
46 from water use, soil erosion, and drainage effects.

1 Small quantities of sanitary wastewater would be generated during the construction and
2 operation of the potential utility-scale solar energy facilities. The amount generated from solar
3 facilities would be in the range of 7 to 74 ac-ft/yr (9,000 to 91,000 m³/yr) during the peak
4 construction year and would range from 0.3 to 6 ac-ft/yr (up to 7,400 m³/yr) during operations.
5 Because of the small quantity, the sanitary wastewater generated by the solar energy facilities
6 would not be expected to put undue strain on available sanitary wastewater treatment facilities
7 in the general area of the SEZ. For technologies that rely on conventional wet-cooling systems,
8 there would also be 66 to 119 ac-ft/yr (81,000 to 150,000 m³/yr) of blowdown water from
9 cooling towers. Blowdown water would need to be either treated on-site or sent to an off-site
10 facility. Any on-site treatment of wastewater would have to ensure that treatment ponds are
11 effectively lined in order to prevent any groundwater contamination. Thus, blowdown water
12 would not contribute to cumulative effects on treatment systems or on groundwater.
13
14

15 **8.3.22.4.9 Vegetation**

16
17 The proposed Gillespie SEZ is located within the Sonoran Basin and Range ecoregion,
18 which supports creosotebush-bur sage plant communities with large areas of paloverde-cactus
19 shrub and saguaro cactus communities. Lands within the SEZ are classified primarily as Sonora–
20 Mojave Creosotebush–White Bursage Desert Scrub. Sensitive habitats on the SEZ include desert
21 dry washes and dry wash woodlands. In the 5-mi (8-km) area of indirect effects, the predominant
22 cover types are Sonora–Mojave Creosotebush–White Bursage Desert Scrub and Sonoran
23 Paloverde-Mixed Cacti Desert Scrub (Section 8.3.10.1). If utility-scale solar energy projects
24 were to be constructed within the SEZ, all vegetation within the footprints of the facilities would
25 likely be removed during land-clearing and land-grading operations. Full development of the
26 SEZ over 80% of its area would result in small impacts on all cover types (Section 8.3.10.2.1).
27 Intermittently flooded areas downgradient from solar projects or access roads could be affected
28 by ground-disturbing activities. Alteration of surface drainage patterns or hydrology could
29 adversely affect on-site and downstream riverine wetlands and dry wash communities, including
30 woodland communities of paloverde, ironwood, and mesquite. In addition, mesquite bosque
31 communities and scrub-shrub, emergent, and other wetland habitats along the Gila River could
32 be impacted by lower groundwater levels if solar projects were to draw heavily on this resource.
33

34 The fugitive dust generated during the construction of the solar facilities could increase
35 the dust loading in habitats outside a solar project area, in combination with that from other
36 construction, mining, agriculture, recreation, and transportation activities. The cumulative
37 dust loading could result in reduced productivity or changes in plant community composition.
38 Similarly, surface runoff from project areas after heavy rains could increase sedimentation and
39 siltation in areas downstream. Implementation of programmatic design features would reduce the
40 impacts from solar energy projects and thus reduce the overall cumulative impacts on plant
41 communities and habitats.
42

43 While most of the cover types within the SEZ are relatively common in the SEZ region,
44 a number of species along the assumed access road route are relatively uncommon, representing
45 less than 1 % of the land area within the region. Thus, other ongoing and reasonably foreseeable
46 future actions could have a cumulative effect on these and other rare cover types, as well as on

1 more abundant species. Such effects would likely be small for foreseeable development due to
2 the abundance of the primary species and the relatively small number of foreseeable actions
3 within the geographic extent of effects, mainly the fast-track Sonoran Solar Energy Project
4 located 12 mi (19 km) to the east of the SEZ. However, given the large number of pending solar
5 applications within this area and the large acreages potentially disturbed (Section 8.3.22.2.1),
6 depending on where any eventual projects are located, up to moderate cumulative effects on
7 some rare cover types are possible. In addition, cumulative effects on wetland species could
8 occur from water use, drainage modifications, and stream sedimentation from these and any
9 other potential future developments in the region. The magnitude of such effects is difficult to
10 predict at the current time.

11 12 13 **8.3.22.4.10 Wildlife and Aquatic Biota** 14

15 Wildlife species that could potentially be affected by the development of utility-scale
16 solar energy facilities in the proposed Gillespie SEZ include amphibians, reptiles, birds, and
17 mammals. The construction of utility-scale solar energy projects in the SEZ and any associated
18 transmission lines and roads in or near the SEZ would have an impact on wildlife through habitat
19 disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, loss of
20 connectivity between natural areas, and wildlife injury or mortality. In general, species with
21 broad distributions and a variety of habitats would be less affected than species with a narrowly
22 defined habitat within a restricted area. The required design features would reduce the severity of
23 impacts on wildlife. The required design features include pre-disturbance biological surveys to
24 identify key habitat areas used by wildlife, followed by avoidance or minimization of disturbance
25 to those habitats.

26
27 As noted in Section 8.3.22.2, other ongoing, reasonably foreseeable and potential future
28 actions within 50 mi (80 km) of the proposed SEZ include one fast-track solar application and
29 22 other pending solar development applications (Figure 8.3.22.2-1). Impacts from full build-out
30 over 80% of the proposed SEZ would result in small impacts on amphibian, reptile, bird, and
31 mammal species (Section 8.3.11). Impacts from foreseeable development within the 50-mi
32 (80-km) geographic extent of effects could exceed those of the SEZ. The fast-track Sonoran
33 Solar Energy Project would remove over 3,600 acres of Sonora Creosotebush–Bursage Desert
34 Scrub wildlife habitat in an area 12 mi (19 km) to the east of the SEZ (BLM 2010c), an area
35 nearly double that assumed to be removed in the SEZ. In addition, there are 22 other pending
36 solar applications in the region that, if built, would disturb similarly large areas. While many of
37 the wildlife species present within the proposed SEZ have extensive available habitat within the
38 region, cumulative effects from all future development in the region on some species could be
39 moderate, depending on the number and location of pending solar projects actually built.

40
41 There are no surface water bodies, perennial or intermittent streams, or mapped wetlands
42 present within the proposed Gillespie SEZ. Several perennial and intermittent streams are present
43 within the 5-mi (8-km) area of indirect effects, including 5 mi (8 km) of the perennial Gila River.
44 However, this portion of the Gila River is not a high quality perennial stream. The intermittent
45 Centennial Wash flows to the Gila River. This and other ephemeral washes are typically dry
46 and flow only after precipitation. They may contain aquatic habitat and aquatic species when

1 sufficient water is present. Better habitat would lie further out in the 50-mi (80-km) geographic
2 extent of effects, including in high quality portions of the Gila River (Section 8.3.11.2). Aquatic
3 habitats within the area of indirect effects may be affected by solar development in the SEZ,
4 but impacts would be mitigated. Thus, there would be only minor contributions to cumulative
5 impacts on aquatic biota and habitats resulting from groundwater drawdown or soil transport to
6 surface streams from solar facilities within the SEZ. Additional similar impacts may accrue on
7 the affected portions of the Gila River from the foreseeable Sonoran Solar Energy Project located
8 12 mi (19 km) to the east.

9 10 11 **8.3.22.4.11 Special Status Species (Threatened, Endangered, Sensitive, 12 and Rare Species)** 13

14 On the basis of recorded occurrences or suitable habitat, as many as 29 special
15 status species could occur within the Gillespie SEZ. Of these species, 10 are known or are
16 likely to occur within the affected area of the SEZ (including the SEZ, the 5-mi [8-km] area of
17 indirect effects, and road and transmission ROWs): California barrel cactus, straw-top cholla,
18 roundtail chub, lowland leopard frog, Sonoran desert tortoise, southwestern willow flycatcher,
19 western yellow-billed cuckoo, Yuma clapper rail, California leaf-nosed bat, and cave myotis.
20 Section 8.3.12.1 discusses the nature of the special status listing of these species within state
21 and federal agencies. Numerous additional species that may occur on or in the vicinity of the
22 SEZ are listed as threatened or endangered by the State of Arizona or listed as a sensitive species
23 by the BLM. Design features to be used to reduce or eliminate the potential for effects on these
24 species from the construction and operation of utility-scale solar energy facilities in the SEZ and
25 related facilities (e.g., access roads and transmission line connections) outside the SEZ include
26 avoidance of habitat and minimization of erosion, sedimentation, and dust deposition. Ongoing
27 effects on special status species include those from roads, transmission lines, and recreational
28 activities in the area. Special status species are also likely present in or around areas identified
29 for future solar developments outside the SEZ within the 50-mi (80-km) geographic extent of
30 effects, as these areas would have similar habitat as the SEZ. For example, BLM-designated
31 habitat for the desert tortoise lies within 1.2 mi (1.9 km) of the project area for the fast-track
32 Sonoran Solar Energy Project (BLM 2010c), which lies 12 mi (19 km) east of the SEZ. Special
33 status species present on or near the SEZ are also likely to be present on or near many of the
34 22 pending solar applications for solar projects within 50-mi (80-km) of the SEZ. Cumulative
35 impacts on protected species are expected to be relatively low for foreseeable development, but
36 could rise if a large number of the pending solar applications are actually built. Actual impacts
37 would further depend on the location and cooling technologies of projects that are built. Projects
38 would employ mitigation measures to limit effects.

39 40 41 **8.3.22.4.12 Air Quality and Climate** 42

43 While solar energy generates minimal emissions compared with fossil fuels, the site
44 preparation and construction activities associated with solar energy facilities would be
45 responsible for some amount of air pollutants. Most of the emissions would be particulate matter
46 (fugitive dust) and emissions from vehicles and construction equipment. When these emissions

1 are combined with those from other nearby projects outside the proposed Gillespie SEZ or when
2 they are added to natural dust generation from winds and windstorms, the air quality in the
3 general vicinity of the projects could be temporarily degraded. For example, the maximum
4 24-hour PM₁₀ concentration at or near the SEZ boundaries could at times exceed the applicable
5 standard of 150 µg/m³. The dust generation from the construction activities can be controlled by
6 implementing aggressive dust control measures, such as increased watering frequency or road
7 paving or treatment.
8

9 Ozone, PM₁₀, and PM_{2.5}, are of regional concern in the area, due to high temperatures,
10 abundant sunshine, and windblown dust from occasional high winds and dry soil conditions.
11 Construction of solar facilities in the SEZ in addition to several ongoing and potential future
12 sources in the geographic extent of effects could contribute cumulatively to short-term PM
13 increases. The fast-track Sonoran Solar Energy Project as well as potential solar projects could
14 produce cumulative PM effects should construction schedules overlap significantly in time and
15 affected area with any projects within the SEZ. Such cumulative air quality effects due to dust
16 emissions during any overlapping construction periods are expected to be small and short-term.
17

18 Over the long term and across the region, the development of solar energy may have
19 beneficial cumulative impacts on the air quality and atmospheric values by offsetting the need
20 for energy production that results in higher levels of emissions, such as coal, oil, and natural gas.
21 As discussed in Section 8.3.22.2.2, air emissions from operating solar energy facilities are
22 relatively minor, while the displacement of criteria air pollutants, VOCs, TAPs, and GHG
23 emissions currently produced from fossil fuels could be significant. For small SEZs, such offsets
24 are fairly modest. For example, if the Gillespie SEZ were fully developed (80% of its acreage)
25 with solar facilities, the quantity of pollutants avoided could be as large as 1.1% of all emissions
26 from the current electric power systems in Arizona.
27
28

29 **8.3.22.4.13 Visual Resources**

30

31 The proposed Gillespie SEZ is located in Maricopa County within a relatively
32 flat, desert floor, with desert washes, a the strong horizon line, and surrounding mountain
33 ranges being the dominant visual features (Section 8.3.14.1). The area is semi-rural/industrial
34 in character. Cultural modifications within the SEZ include unpaved roads, and fencing, and
35 outside the SEZ include the Palo Verde nuclear power plant, three natural gas power plants, a
36 railroad, transmission lines, and a pipeline ROW. The VRI values for the SEZ and immediate
37 surroundings are VRI Class III, indicating moderate visual values. The inventory indicates low
38 scenic quality for the SEZ and its immediate surroundings; however, the inventory indicates high
39 sensitivity for the SEZ and its immediate surroundings because of the SEZ's proximity to Agua
40 Caliente Road, a BLM-proposed backcountry byway, and a scenic, high-use travel corridor with
41 high levels of public interest.
42

43 Construction of utility-scale solar facilities on the SEZ and associated transmission lines
44 outside the SEZ would alter the natural scenic quality of the immediate area. Because of the
45 large size of utility-scale solar energy facilities and the generally flat, open nature of the
46 proposed SEZ, some lands outside the SEZ would also be subjected to visual impacts related to

1 the construction, operation, and decommissioning of utility-scale solar energy facilities. Visual
2 impacts resulting from solar energy development within the SEZ would be in addition to impacts
3 caused by other potential projects in the area such as other solar facilities on private lands,
4 transmission lines, and other renewable energy facilities, such as wind mills. The presence of
5 new facilities would normally be accompanied by increased numbers of workers in the area,
6 traffic on local roadways, and support facilities, all of which would add to cumulative visual
7 impacts.

8
9 There is currently one fast-track solar facility application, the Sonoran Solar Energy
10 Project 12 mi (19 km) east of the SEZ, and 22 other pending solar applications within 50 mi
11 (80 km) of the SEZ (Figure 8.3.22.2-1). While the contribution to cumulative impacts in the area
12 of foreseeable and potential projects would depend on the location of facilities that are actually
13 built, it may be concluded that the general visual character of the landscape within this distance
14 could be cumulatively impacted by the presence of solar facilities, transmission lines, and other
15 new infrastructure. Because of the topography of the region, such developments, located in basin
16 flats, would be visible at great distances from surrounding mountains, which include sensitive
17 viewsheds. Given the proximity of several of the pending solar applications to the proposed
18 SEZ and to each other, it is possible that two or more facilities would be viewable from a single
19 location. In addition, facilities would be located near major roads and thus would be viewable by
20 motorists, who would also be viewing transmission lines, towns, and other infrastructure, as well
21 as the road system itself.

22
23 As additional facilities are added, several projects might become visible from one
24 location, or in succession, as viewers move through the landscape, as by driving on local roads.
25 In general, the new facilities would be expected to vary in appearance, and depending on the
26 number and type of facilities, the resulting visual disharmony could exceed the visual absorption
27 capability of the landscape and add significantly to the cumulative visual impact. Considering the
28 above and the large number of pending solar applications in the region, moderate cumulative
29 visual impacts could occur within the geographic extent of effects from future solar and other
30 existing and future development.

31 32 33 **8.3.22.4.14 Acoustic Environment**

34
35 The areas around the proposed Gillespie SEZ are classified as rural to industrial.
36 Existing noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover,
37 agricultural activities, cattle grazing, and from industrial activities (power plants).
38 The construction of solar energy facilities could increase the noise levels periodically for up
39 to 3 years per facility, but there would be little or minor noise impacts during operation of solar
40 facilities, except from solar dish engine facilities and from parabolic trough or power tower
41 facilities using TES, which could affect nearby residences.

42
43 Other ongoing and reasonably foreseeable and potential future activities in the general
44 vicinity of the SEZ are described in Section 8.3.22.2. Because proposed projects and nearest
45 residents are relatively far from the SEZ with respect to noise impacts and the local area is

1 sparsely populated, cumulative noise effects during the construction or operation of solar
2 facilities are unlikely.

3 4 5 **8.3.22.4.15 Paleontological Resources**

6
7 The proposed Gillespie SEZ has unknown potential for the occurrence of significant
8 fossil material over its entire extent and requires further investigation prior to project approval
9 (Section 8.3.16.1). Any paleontological resources encountered during a paleontological survey
10 would be mitigated to the extent possible. Cumulative impacts on paleontological resources
11 would be dependent on whether significant resources are found within the SEZ and in additional
12 project areas in the region.

13 14 15 **8.3.22.4.16 Cultural Resources**

16
17 The proposed Gillespie SEZ is rich in cultural history, with settlements dating as far back
18 as 12,000 years, and has the potential to contain significant cultural resources. Areas with the
19 greatest potential for significant sites within the proposed SEZ include the eastern portion of the
20 SEZ, close to the Gila River, and north of the SEZ near the Southern Pacific Railroad, which
21 have potential for containing prehistoric sites and historic sites (Section 8.5.1.7.2). Five surveys
22 have been conducted within the boundaries and covering a small portion of the SEZ. These
23 surveys have not recorded any resources. However, 59 surveys conducted within 5 mi (8 km) of
24 the SEZ resulted in the recording of 30 sites within this range (Section 8.3.17.1.5). It is possible,
25 but unlikely, that the development of utility-scale solar energy projects in the SEZ, when added
26 to other potential projects likely to occur in the area, could contribute cumulatively to cultural
27 resource impacts occurring in the region. One major foreseeable development, the fast-track
28 Sonoran Solar Energy Project located 12 mi (19 km) to the east, has been identified within the
29 25-mi (40-km) geographic extent of effects. In addition, 22 potential solar projects with pending
30 applications lie within this distance (Section 8.3.22.2). While any future solar projects would
31 disturb large areas, the specific sites selected for future projects would be surveyed; historic
32 properties encountered would be avoided or mitigated to the extent possible. Through ongoing
33 consultation with the Arizona SHPO and appropriate Native American governments, it is
34 likely that most adverse effects on significant resources in the region could be mitigated to
35 some degree. While avoidance of all NRHP-eligible sites and mitigation of all impacts may not
36 be possible, it is unlikely that any sites recorded in the SEZ would be of such individual
37 significance that development would cumulatively cause an irretrievable loss of information
38 about a significant resource type.

39 40 41 **8.3.22.4.17 Native American Concerns**

42
43 Government-to-government consultation is under way with federally recognized Native
44 American Tribes with possible traditional ties to the Gillespie area. All such Tribes have been
45 contacted and provided an opportunity to comment or consult regarding this PEIS. To date, no
46 specific concerns have been raised to the BLM regarding the proposed Gillespie SEZ. However,

1 impacts of solar development in the SEZ and in the surrounding area on water resources is likely
2 to be of major concern to affected tribes, as are intrusions on the landscape and impacts on plants
3 and game and on traditional resources at specific locations (Section 8.3.18). The development
4 of solar energy facilities in combination with the development of other planned and foreseeable
5 projects in the area would likely reduce the traditionally important plant and animal resources
6 available to the Tribes. Such effects would likely be small for foreseeable development due to
7 the abundance of the most culturally important plant species and the relatively small number
8 of foreseeable actions within the geographic extent of effects. Continued discussions with area
9 Tribes through government-to-government consultation is necessary to effectively consider and
10 address the Tribes' concerns tied to solar energy development in the Gillespie SEZ.
11
12

13 **8.3.22.4.18 Socioeconomics**

14

15 Solar energy development projects in the proposed Gillespie SEZ could cumulatively
16 contribute to socioeconomic effects in the immediate vicinity of the SEZ and in the surrounding
17 multicounty ROI. The effects could be positive (e.g., creation of jobs and generation of extra
18 income, increased revenues to local governmental organizations through additional taxes paid by
19 the developers and workers) or negative (e.g., added strain on social institutions such as schools,
20 police protection, and health care facilities). Impacts from solar development would be most
21 intense during facility construction, but of greatest duration during operations. Construction
22 would temporarily increase the number of workers in the area needing housing and services in
23 combination with temporary workers involved in other new development in the area, including
24 other renewable energy projects. The number of workers involved in the construction of solar
25 projects (including the transmission line) in the peak construction year could range from about
26 90 to 1,200, depending on the technology being employed, with solar PV facilities at the low
27 end and solar trough facilities at the high end. The total number of jobs created in the area
28 could range from approximately 150 (solar PV) to as high as 3,800 (solar trough). Cumulative
29 socioeconomic effects in the ROI from construction of solar facilities would occur to the
30 extent that multiple construction projects of any type were ongoing at the same time. It is a
31 reasonable expectation that this condition would occur within a 50-mi (80-km) radius of the
32 SEZ occasionally over the 20-year or more solar development period. For example, peak
33 construction employment for the fast-track Sonoran Solar Energy Project located 12 mi (19 km)
34 east of the SEZ is estimated to be over 1,500 in late 2012 (BLM 2010c).
35

36 Annual impacts during the operation of solar facilities would be less, but of 20- to
37 30-year duration, and could combine with those from other new developments in the area,
38 including from the Sonoran Solar Energy Project, which would employ an estimated 80 full
39 time workers (BLM 2010c). Additional employment would occur at some number of the other
40 22 pending solar applications within 50 mi (80 km) of the proposed SEZ. Based on the
41 assumption of full build-out of the SEZ (Section 8.3.19.2.2), the number of workers needed at
42 the solar facilities in the SEZ would range from 5 to 90, with approximately 6 to 290 total jobs
43 created in the region. Population increases would contribute to general upward trends in the
44 region in recent years. The socioeconomic impacts overall would be positive, through the
45 creation of additional jobs and income. The negative impacts, including some short-term

1 disruption of rural community quality of life, would not likely be considered large enough to
2 require specific mitigation measures.

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5 **8.3.22.4.19 Environmental Justice**
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7 Any impacts from solar development could have cumulative impacts on minority and
8 low-income populations within 50 mi (80 km) of the proposed SEZ in combination with other
9 development in the area. Such impacts could be both positive, such as from increased economic
10 activity, and negative, such as from visual impacts, noise, and exposure to fugitive dust
11 (Section 8.3.20.2). Actual impacts would depend on where low-income populations are located
12 relative to solar and other proposed facilities and on the geographic range of effects. Overall,
13 effects from facilities within the SEZ are expected to be small, while other foreseeable and
14 potential actions would not likely combine with negative effects from the SEZ on minority or
15 low-income populations, with the possible exception of visual impacts from solar development
16 in the region. Thus, it is not expected that the proposed Gillespie SEZ would contribute to
17 cumulative impacts on minority and low-income populations.
18

19
20 **8.3.22.4.20 Transportation**
21

22 Old U.S. 80 lies 3 mi (5 km) east of the proposed Gillespie SEZ. The nearest public
23 airport is the Buckeye Municipal Airport, 20 mi (32 km) to the northeast of the SEZ. The nearest
24 railroad stop is also in Buckeye. During construction of utility-scale solar energy facilities, up to
25 1,000 workers could be commuting to the construction site at the SEZ at a given time, which
26 could increase the AADT on these roads by 2,000 vehicle trips for each facility under
27 construction. Traffic on Old U.S. 80 could experience moderate slowdowns during construction
28 shift changes (Section 8.3.21.2). This increase in highway traffic from construction workers
29 could likewise have small cumulative impacts in combination with existing traffic levels and
30 increases from additional future development in the area, including from construction of the fast-
31 track Sonoran Solar Energy Project east of State Route 85, as well as from other potential solar
32 facilities with pending applications in the region, should construction schedules overlap. Local
33 road improvements in addition to turn lanes might be necessary on affected portions of Old
34 U.S. 80. Any impacts during construction activities would be temporary. The impacts can also
35 be mitigated to some degree by staggered work schedules and ride-sharing programs. Traffic
36 increases during operation would be relatively small because of the low number of workers
37 needed to operate the solar facilities and would have little contribution to cumulative impacts.
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1 **8.3.23 References**

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3 *Note to Reader:* This list of references identifies Web pages and associated URLs where
4 reference data were obtained for the analyses presented in this PEIS. It is likely that at the time
5 of publication of this PEIS, some of these Web pages may no longer be available or their URL
6 addresses may have changed. The original information has been retained and is available through
7 the Public Information Docket for this PEIS.

8
9 ADEQ (Arizona Department of Environmental Quality), 2009, *2009 Air Quality Annual Report*.
10 Available at http://www.azdeq.gov/function/forms/download/2009_Annual_Report-AQD.pdf.
11 Accessed July 24, 2010.

12
13 ADEQ, 2010a, *Nonattainment and Attainment with a Maintenance Plan Areas*. Available at
14 <http://www.azdeq.gov/environ/air/plan/images/notmeet.jpg>. Accessed Aug. 5, 2010.

15
16 ADEQ, 2010b, *Water Quality: Permits: Stormwater*. Available at [http://www.azdeq.gov/](http://www.azdeq.gov/environ/water/permits/stormwater.html)
17 [environ/water/permits/stormwater.html](http://www.azdeq.gov/environ/water/permits/stormwater.html). Accessed July 12, 2010.

18
19 ADOT (Arizona Department of Transportation), 2010, *Average Annual Daily Traffic (AADT)*
20 *AADT Reports (Traffic Counts), Current AADTs, 2006 to 2008*, Multimodal Planning Division.
21 Available at <http://mpd.azdot.gov/mpd/data/aadt.asp>. Accessed July 16, 2010.

22
23 ADWR (Arizona Department of Water Resources), 1999, *Third Management Plan for Phoenix*
24 *Active Management Area, 2000–2010*, Dec.

25
26 ADWR, 2010a, *Arizona Water Atlas*. Available at [http://www.azwater.gov/AzDWR/](http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/default.htm)
27 [StatewidePlanning/WaterAtlas/default.htm](http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/default.htm). Accessed July 8, 2010.

28
29 ADWR, 2010b, *Land Subsidence in the Buckeye Area, Western Maricopa County, 02/25/2006 to*
30 *04/05/2008*. Available at [http://www.azwater.gov/AzDWR/Hydrology/Geophysics/documents/](http://www.azwater.gov/AzDWR/Hydrology/Geophysics/documents/BuckeyeArea2006to2008_8x11.pdf)
31 [BuckeyeArea2006to2008_8x11.pdf](http://www.azwater.gov/AzDWR/Hydrology/Geophysics/documents/BuckeyeArea2006to2008_8x11.pdf). Accessed July 19, 2010.

32
33 ADWR, 2010c, *Overview of the Arizona Groundwater Management Code*. Available at
34 http://www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf.
35 Accessed June 21, 2010.

36
37 ADWR, 2010d, *Water Management Requirements for Solar Power Plants in Arizona*. Available
38 at [http://www.azwater.gov/azdwr/WaterManagement/solar/documents/Solar_Regulation_](http://www.azwater.gov/azdwr/WaterManagement/solar/documents/Solar_Regulation_Summary_FINAL.pdf)
39 [Summary_FINAL.pdf](http://www.azwater.gov/azdwr/WaterManagement/solar/documents/Solar_Regulation_Summary_FINAL.pdf). Accessed June 21, 2010.

40
41 ADWR, 2010e, *Types of Recharge Permits*. Available at [http://www.adwr.state.az.us/AzDWR/](http://www.adwr.state.az.us/AzDWR/WaterManagement/Recharge/TypesofRechargePermits.htm)
42 [WaterManagement/Recharge/TypesofRechargePermits.htm](http://www.adwr.state.az.us/AzDWR/WaterManagement/Recharge/TypesofRechargePermits.htm). Accessed July 20, 2010.

43
44 ADWR, 2010f, *About ADWR*. Available at [http://www.adwr.state.az.us/azdwr/](http://www.adwr.state.az.us/azdwr/PublicInformationOfficer/About_ADWR.htm)
45 [PublicInformationOfficer/About_ADWR.htm](http://www.adwr.state.az.us/azdwr/PublicInformationOfficer/About_ADWR.htm). Accessed June 21, 2010.

1 ADWR, 2010g, *A Practical Guide to Drilling a Well in Arizona*. Available at
2 <http://www.azwater.gov/AzDWR/WaterManagement/Wells/documents/wellguide.pdf>. Accessed
3 July 12, 2010.
4
5 ADWR, 2010h, *Long-term Storage Account Summary*. Available at
6 [http://www.azwater.gov/AzDWR/WaterManagement/Recharge/RechargeCreditsandAccounting.](http://www.azwater.gov/AzDWR/WaterManagement/Recharge/RechargeCreditsandAccounting.htm)
7 [htm](http://www.azwater.gov/AzDWR/WaterManagement/Recharge/RechargeCreditsandAccounting.htm). Accessed July 26, 2010.
8
9 ADWR, 2010i, *Active Management Areas (AMAs) & Irrigation Non-expansion Areas (INAs)*.
10 Available at <http://www.azwater.gov/AzDWR/WaterManagement/AMAs>. Accessed June 22,
11 2010.
12
13 ADWR, 2010j, *Colorado River Management*. Available at [http://www.azwater.gov/](http://www.azwater.gov/AzDWR/StateWidePlanning/CRM/Overview.htm)
14 [AzDWR/StateWidePlanning/CRM/Overview.htm](http://www.azwater.gov/AzDWR/StateWidePlanning/CRM/Overview.htm). Accessed July 21, 2010.
15
16 AECOM (Architectural Engineering, Consulting, Operations and Maintenance), 2009, *Project*
17 *Design Refinements*. Available at [http://energy.ca.gov/sitingcases/beacon/documents/](http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf)
18 [applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf](http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf). Accessed
19 Sept. 2009.
20
21 Allison, L., 2010, *Arizona Geology—Centennial Wash Flood Prone Areas May Be Explained by*
22 *Subsidence*, Blog of the State Geologist and Director, Arizona Geological Survey, Coalition on
23 the Public Understanding of Science, Feb. 9.
24
25 AMA (American Medical Association), 2009, *Physician Characteristics and Distribution in the*
26 *U.S.*, Chicago, Ill. Available at <http://www.ama-assn.org/ama/pub/category/2676.html>.
27
28 Anderson, T.W., 1995, *Summary of the Southwest Alluvial Basins, Regional Aquifer-system*
29 *Analysis, South-central Arizona and Parts of Adjacent States*, U.S. Geological Survey
30 Professional Paper 1406-A.
31
32 ANHP (Arizona Natural Heritage Program), 2010, *Arizona's Natural Heritage Program:*
33 *Heritage Data Management System (HDMS)*. Available at [http://www.azgfd.gov/w_c/](http://www.azgfd.gov/w_c/edits/species_concern.shtml)
34 [edits/species_concern.shtml](http://www.azgfd.gov/w_c/edits/species_concern.shtml). Accessed July 20, 2010.
35
36 Arizona Department of Commerce, 2010, *Arizona Population Projections*. Available at
37 <http://www.azcommerce.com/EconInfo/Demographics/Population+Projections.htm>.
38
39 Arizona Field Ornithologists, 2010, *Field Checklist of the Birds of La Paz County*. Available at
40 <http://azfo.org/documents/LaPaz.pdf>. Accessed July 25, 2010.
41
42 AVSE (Arlington Valley Solar Energy), 2009, *Arlington Valley Solar Energy Projects*. Available
43 at <http://www.avsepublic.com>. Accessed Oct. 18, 2010.
44
45 AWBA (Arizona Water Banking Authority), 2010, *Water Storage*. Available at [http://www.](http://www.azwaterbank.gov/awba)
46 [azwaterbank.gov/awba](http://www.azwaterbank.gov/awba). Accessed July 22, 2010.
47

1 AZDA (Arizona Department of Agriculture), 2010, *Prohibited, Regulated, and Restricted*
2 *Noxious Weeds*, Plant Services Division.
3

4 AZGS (Arizona Geological Survey), 2009, *Earth Fissure Map of the Wintersburg Study Area:*
5 *Maricopa County, Arizona*, Digital Map Series Earth Fissure Map 10 (DM-EF_10), Feb.
6

7 AZGS, 2010, *Locations of Mapped Earth Fissure Traces in Arizona*, *Digital Information 39*
8 *(DI-39)*, Version 6.22.09. Available at <http://www.azgs.az.gov/efresources.shtml>. Accessed
9 July 22, 2010.
10

11 Bahr, D.M., 1983, "Pima and Papago Social Organization," pp. 178192 in *Handbook of*
12 *North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution,
13 Washington, D.C.
14

15 Bailie, A., et al., 2005, *Final Arizona Greenhouse Gas Inventory and Reference Case*
16 *Projections 1990–2020*. Arizona Department of Environmental Quality (ADEQ) and Center for
17 Climate Strategies (CCS), June. Available at [http://azmemory.lib.az.us/cdm4/item_viewer.php?](http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4)
18 [CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4](http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4). Accessed July 20, 2010.
19

20 Beacon Solar, LLC, 2008, *Application for Certification for the Beacon Solar Energy Project*,
21 submitted to the California Energy Commission, March. Available at [http://www.energy.ca.gov/](http://www.energy.ca.gov/sitingcases/beacon/index.html)
22 [sitingcases/beacon/index.html](http://www.energy.ca.gov/sitingcases/beacon/index.html).
23

24 Bean, L.J., et al., 1978, *Persistence and Power: A Study of Native American Peoples in the*
25 *Sonoran Desert and the Devers-Palo Verde High Voltage Transmission Line*, prepared for the
26 Southern California Edison Company by Cultural Systems Research, Inc., Menlo Park, Calif.
27

28 Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control
29 Engineering, Washington, D.C.
30

31 BLM (Bureau of Land Management), undated, Sonoran Desert/Phoenix South Planning Reports
32 Web site and associated documents, reports, and maps. Available at [http://www.blm.gov/az/st/](http://www.blm.gov/az/st/en/prog/planning/son_des/reports.html)
33 [en/prog/planning/son_des/reports.html](http://www.blm.gov/az/st/en/prog/planning/son_des/reports.html). Accessed Aug. 2, 2010.
34

35 BLM, 1980, *Green River—Hams Fork Draft Environmental Impact Statement: Coal*,
36 U.S. Department of the Interior, Denver, Colo.
37

38 BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale*
39 *Leasing Program*, U.S. Department of the Interior, Denver, Colo.
40

41 BLM, 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24,
42 U.S. Department of the Interior.
43

44 BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410-1, Release 8-28,
45 U.S. Department of the Interior, Jan.
46

1 BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30,
2 U.S. Department of the Interior, Jan.
3
4 BLM, 1996, *White River Resource Area: Proposed Resource Management Plan and Final*
5 *Environmental Impacts Statement*, White River Resource Area, Craig, Colo.
6
7 BLM, 2001, *Arizona Water Rights Fact Sheet*. Available at [http://www.blm.gov/nstc/](http://www.blm.gov/nstc/WaterLaws/arizona.html)
8 [WaterLaws/arizona.html](http://www.blm.gov/nstc/WaterLaws/arizona.html).
9
10 BLM, 2005, *Approved Amendment to the Lower Gila North Management Framework Plan and*
11 *the Lower Gila South Resource Management Plan and Decision Record*, U.S. Department of the
12 Interior, Bureau of Land Management, Phoenix Field Office, Arizona, July.
13
14 BLM, 2006, *Lake Havasu Field Office Proposed Resource Management Plan and Final*
15 *Environmental Impact Statement*, Lake Havasu Field Office, Lake Havasu City, Ariz., Sept.
16
17 BLM, 2007a, *Record of Decision and Lake Havasu Field Office Approved Resource*
18 *Management Plan*, Lake Havasu Field Office, Lake Havasu City, Ariz., May. Available at
19 [http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/](http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/LHFO_ROD_07.html)
20 [LHFO_ROD_07.html](http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/LHFO_ROD_07.html).
21
22 BLM, 2007b, *Potential Fossil Yield Classification (PFYC) System for Paleontological Resources*
23 *on Public Lands*, Instruction Memorandum No. 2008-009, with attachments, Washington, D.C.,
24 Oct. 15.
25
26 BLM, 2007c, *Oil Shale and Tar Sands Resource Management Plan Amendments to Address*
27 *Land Use Allocations in Colorado, Utah, and Wyoming and Programmatic Environmental*
28 *Impact Statement*, U.S. Department of the Interior, Dec.
29
30 BLM, 2008a, *Special Status Species Management*, BLM Manual 6840, Release 6-125,
31 U.S. Department of the Interior, Dec. 12.
32
33 BLM, 2008b, *Assessment and Mitigation of Potential Impacts to Paleontological Resources*,
34 Instruction Memorandum No. 2009-011, with attachments, Washington, D.C., Oct. 10.
35
36 BLM, 2008c, *Rangeland Administration System*. Available at <http://www.blm.gov/ras/index.htm>,
37 last updated Aug. 24, 2009.
38
39 BLM, 2010a, *Draft Visual Resource Inventory*, U.S. Department of the Interior, Bureau of Land
40 Management, Lower Sonoran Field Office, Phoenix, Ariz., May.
41
42 BLM, 2010b, *Sonoran Solar Energy Project: Draft Environmental Impact Statement*. Available
43 at http://www.blm.gov/az/st/en/prog/energy/solar/sonoran_solar/maps/DEIS.html.
44

1 BLM, 2010c, *Bradshaw-Haquahala Record of Decision Approved Resource Management Plan*.
2 Available at [https://www.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?](https://www.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?method=dispatchToPatternPage¤tPageId=10422)
3 [method=dispatchToPatternPage¤tPageId=10422](https://www.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?method=dispatchToPatternPage¤tPageId=10422).
4
5 BLM, 2010d, *Wild Horse and Burro Statistics and Maps*. Available at http://www.blm.gov/wo/st/en/prog/wild_horse_and_burro/wh_b_information_center/statistics_and_maps/ha_and_hma_data.html. Accessed June 25, 2010.
6
7
8
9 BLM, 2010e, *Solar Energy Interim Rental Policy*, U.S. Department of the Interior. Available at
10 [http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national](http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-141.html)
11 [instruction/2010/IM_2010-141.html](http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-141.html).
12
13 BLM and USFS, 2010a, *GeoCommunicator: Mining Claim Map*. Available at
14 <http://www.geocommunicator.gov/GeoComm/index.shtm>. Accessed June 21, 2010.
15
16 BLM and USFS, 2010b, *GeoCommunicator: Energy Map Viewer*. Available at
17 <http://www.geocommunicator.gov/GeoComm/index.shtm>. Accessed March 26, 2010.
18
19 Brennan, T.C., 2008, *Online Field Guide to the Reptiles and Amphibians of Arizona*. Available at
20 <http://www.reptilesfaz.org/index.html>. Accessed July 16, 2010.
21
22 BTS (Bureau of Transportation Statistics), 2009, *Air Carriers: T-100 Domestic Segment*
23 *(All Carriers)*, Research and Innovative Technology Administration, U.S. Department of
24 Transportation, Dec. Available at http://www.transtats.bts.gov/Fields.asp?Table_ID=311.
25 Accessed March 5, 2010.
26
27 Bui, L., 2010, *Palo Verde Water Deal a Boost for Scottsdale's Coffers*, Azcentral.com, April 15.
28 Available at [http://www.azcentral.com/news/articles/2010/04/15/20100415palo-verde-water-](http://www.azcentral.com/news/articles/2010/04/15/20100415palo-verde-water-deal-scottsdale.html)
29 [deal-scottsdale.html](http://www.azcentral.com/news/articles/2010/04/15/20100415palo-verde-water-deal-scottsdale.html). Accessed July 22, 2010.
30
31 CalPIF (California Partners in Flight), 2009, *The Desert Bird Conservation Plan: A Strategy for*
32 *Protecting and Managing Desert Habitats and Associated Birds in California, Version 1.0*.
33 Available at <http://www.prbo.org/calpif/plans.html>. Accessed March 3, 2010.
34
35 CAP (Central Arizona Project), 2010, *Central Arizona Project Home Page*. Available at
36 <http://www.cap-az.com>. Accessed July 15, 2010.
37
38 CDC (Centers for Disease Control and Prevention), 2009, *Divorce Rates by State: 1990, 1995,*
39 *1999–2007*. Available at
40 <http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf>.
41
42 CDFG (California Department of Fish and Game), 2008, *Life History Accounts and Range*
43 *Maps—California Wildlife Habitat Relationships System*, California Department of Fish and
44 Game, Sacramento, Calif. Available at <http://dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx>.
45 Accessed Feb. 19, 2010.
46

1 CEQ (Council on Environmental Quality), 1997, *Environmental Justice: Guidance under the*
2 *National Environmental Policy Act*, Executive Office of the President, Dec. Available at
3 <http://ceq.hss.doe.gov/nepa/regs/ej/justice.pdf>.
4

5 Chase, M.K., and G.R. Geupel, 2005, “The Use of Avian Focal Species for Conservation
6 Planning in California,” pp. 130–142 in *Bird Conservation Implementation and Integration*
7 *in the Americas: Proceedings of the Third International Partners in Flight Conference*
8 *March 20–24, 2002, Asilomar, Calif.*, Vol. 1, Gen. Tech. Rep. PSW-GTR-191, C.J. Ralph and
9 T.D. Rich (editors), U.S. Department of Agriculture, Forest Service, Pacific Southwest Research
10 Station, Albany, Calif.

11

12 Cowherd, C., et al., 1988, *Control of Open Fugitive Dust Sources*, EPA 450/3-88-008,
13 U.S. Environmental Protection Agency, Research Triangle Park, N.C.

14

15 CSC (Coastal Services Center), 2010, *Historical Hurricane Tracks*, National Oceanic and
16 Atmospheric Administration. Available at <http://csc-s-maps-q.csc.noaa.gov/hurricanes>. Accessed
17 July 20, 2010.

18

19 DeJong, D.H., 2004, “Forced to Abandon Their Farms: Water Deprivation and Starvation among
20 the Gila River Pima, 1892–1904,” *American Indian Culture and Research Journal*, 28(2):29–56.
21

22 DeJong, D.H., 2007, “Abandoned Little by Little: the 1914 Pima Adjudication Survey, Water
23 Deprivation, and Farming on the Pima Reservation,” *Agricultural History*, 81(4):36–69.
24

25 Desert Tortoise Council, 1994 (Revised 1999), *Guidelines for Handling Desert Tortoises during*
26 *Construction Projects*, E.L. LaRue, Jr. (editor), Wrightwood, Calif.

27

28 DOE (U.S. Department of Energy), 2009a, *Report to Congress, Concentrating Solar Power*
29 *Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power*
30 *Electricity Generation*, Jan. 13.

31

32 DOE, 2009b, *Palo Verde Nuclear Generating Station, Arizona*. Available at
33 http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/palo_verde.html. Accessed
34 July 29, 2010.

35

36 DSIRE (Database of State Incentives for Renewables & Efficiency), 2010, *Arizona*
37 *Incentives/Policies for Renewables & Efficiency*, U.S. Department of Energy, North Carolina
38 Solar Center, North Carolina State University. Available at
39 http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ03R&re=1&ee=1.
40 Accessed July 14, 2010.

41

42 DuBois, S.M., and A.W. Smith, 1980, “Earthquakes Causing Damage in Arizona,” in *Fieldnotes*
43 *from the Arizona Bureau of Geology and Mineral Technology*, Sept.

44

45 EIA (Energy Information Administration), 2009, *Annual Energy Outlook 2009 with Projections*
46 *to 2030*, DOE/EIA-0383, March.

1 Eldred, K.M., 1982, "Standards and Criteria for Noise Control—An Overview," *Noise Control*
2 *Engineering* 18(1):16–23.
3

4 EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental*
5 *Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*,
6 EPA-550/9-74-004, Washington, D.C., March. Available at [http://www.nonoise.org/library/](http://www.nonoise.org/library/levels74/levels74.htm)
7 [levels74/levels74.htm](http://www.nonoise.org/library/levels74/levels74.htm). Accessed Nov. 17, 2008.
8

9 EPA, 2002, *Primary Distinguishing Characteristics of Level III Ecoregions of the Continental*
10 *United States, Draft*. Available at http://www.epa.gov/wed/ecoregions/us/useco_desc.doc.
11 Accessed Oct. 2, 2008.
12

13 EPA, 2007, *Level III Ecoregions of the Continental United States*, revised March 2007, National
14 Health and Environmental Effects Research Laboratory, Western Ecology Division, Corvallis,
15 Ore. Available at http://www.epa.gov/wed/pages/ecoregions/level_iii.htm. Accessed Oct. 2,
16 2008.
17

18 EPA 2009a, *National Primary Drinking Water Regulations and National Secondary Drinking*
19 *Water Regulation*. Available at <http://www.epa.gov/safewater/standard/index.html>.
20

21 EPA, 2009b, *Energy CO₂ Emissions by State*. Available at [http://www.epa.gov/climatechange/](http://www.epa.gov/climatechange/emissions/state_energyco2inv.html)
22 [emissions/state_energyco2inv.html](http://www.epa.gov/climatechange/emissions/state_energyco2inv.html), last updated June 12, 2009. Accessed June 23, 2009.
23

24 EPA, 2009c, *Preferred/Recommended Models—AERMOD Modeling System*. Available at
25 http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed Nov. 8, 2009.
26

27 EPA, 2009d, *eGRID*. Available at [http://www.epa.gov/cleanenergy/energy-resources/egrid/](http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html)
28 [index.html](http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html), last updated Oct. 16, 2008. Accessed Jan. 12, 2009.
29

30 EPA, 2010a, *National Ambient Air Quality Standards (NAAQS)*. Available at [http://www.epa.](http://www.epa.gov/air/criteria.html)
31 [gov/air/criteria.html](http://www.epa.gov/air/criteria.html), last updated June 3, 2010. Accessed June 4, 2010.
32

33 EPA, 2010b, *AirData: Access to Air Pollution Data*. Available at <http://www.epa.gov/oar/data>.
34 Accessed July 20, 2010.
35

36 Ezell, P.H., 1983, "History of the Pima," pp. 149–160 in *Handbook of North American Indians*,
37 *Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.
38

39 FAA (Federal Aviation Administration), 2010, *Airport Data (5010) & Contact Information*,
40 *Information Current as of 06/03/2010*. Available at
41 http://www.faa.gov/airports/airport_safety/airportdata_5010. Accessed July 19, 2010.
42

43 Farish, T.E., 1915, *History of Arizona*, Filmer Brothers Electrotpe Company, San Francisco,
44 Calif.
45

1 Fellows, L.D., 2000, "Volcanism in Arizona," *Arizona Geology* 30(4):1–4. Available at
2 http://www.azgs.az.gov/hazards_volcanoes.shtml. Accessed July 22, 2010.
3
4 FEMA (Federal Emergency Management Agency), 2009, *FEMA Map Service Center*.
5 Available at [http://msc.fema.gov/webapp/wcs/stores/servlet/
6 FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1](http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1). Accessed Nov. 20, 2009.
7
8 Field, K.J., et al., 2007, "Return to the Wild: Translocation as a Tool in Conservation of the
9 Desert Tortoise (*Gopherus agassizii*)," *Biological Conservation* 136: 232-245.
10
11 Fire Departments Network, 2009, *Fire Departments by State*. Available at
12 <http://www.firedepartments.net>.
13
14 Fontana, B.L., 1983a, "Pima and Papago: Introduction," pp. 125–134 in *Handbook of North
15 American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington,
16 D.C.
17
18 Fontana, B.L., 1983b, "History of the Papago," pp. 137–148 in *Handbook of North American
19 Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.
20
21 Freethy, G.W., and T.W. Anderson, 1986, *Predevelopment Hydrologic Conditions in the Alluvial
22 Basins of Arizona and Adjacent Parts of California and New Mexico*, USGS Hydrologic
23 Investigations Atlas HA-664.
24
25 Galloway, D., et al., 1999, *Land Subsidence in the United States*, U.S. Geological Survey
26 Circular 1182.
27
28 GCRP (U.S. Global Change Research Program), 2009, *Global Climate Change Impacts in the
29 United States: A State of Knowledge Report from the U.S. Global Change Research Program*,
30 Cambridge University Press, Cambridge, Mass. Available at [http://downloads.globalchange.gov/
31 usimpacts/pdfs/climate-impacts-report.pdf](http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf). Accessed Jan. 25, 2010.
32
33 Giffen, R., 2009, "Rangeland Management Web Mail," personal communication from Giffen
34 (USDA Forest Service, Rangelands Management, Washington, D.C.) to W. Vinikour (Argonne
35 National Laboratory, Argonne, Ill.), Sept. 22, 2009.
36
37 Hackenberg, R.A, 1983. "Pima and Papago Ecological Adaptations," pp. 161–177 in *Handbook
38 of North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution,
39 Washington, D.C.
40
41 Hanson, C.E., et al., 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-
42 06, prepared by Harris Miller Miller & Hanson Inc., Burlington, Mass., for U.S. Department of
43 Transportation, Federal Transit Administration, Washington, D.C., May. Available at
44 http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.
45

1 Harwell, H.O., and M.C.S. Kelly, 1983, "Maricopa," pp. 71–85 in *Handbook of North American*
2 *Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.
3

4 Hoffmeister, D.F., 1986, *Mammals of Arizona*, The University of Arizona Press, Tucson, Ariz.
5

6 Jackson, M., Sr., 2009, "Quechan Indian Tribe's Comments on Programmatic Environmental
7 Impact Statement for Solar Energy Development," letter from Jackson (President, Quechan
8 Indian Tribe, Fort Yuma, Ariz.) to Argonne National Laboratory (Argonne, Ill.), Sept. 3.
9

10 Joseph, A., 1949, *The Desert People: A Study of the Papago Indians*, University of Chicago
11 Press, Chicago, Ill.
12

13 Kenny, J.F., et al., 2009, *Estimated Use of Water in the United States in 2005*, U.S. Geological
14 Survey, Circular 1344. Available at <http://pubs.usgs.gov/circ/1344>. Accessed Jan. 4, 2010.
15

16 Kessell, J.L., 2002, *Spain in the Southwest*, University of Oklahoma Press, Norman, Okla.
17

18 Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*,
19 Bonneville Power Administration, Portland, Ore., Dec.
20

21 Levick, L., et al., 2008, *The Ecological and Hydrological Significance of Ephemeral and*
22 *Intermittent Streams in the Arid and Semi-arid American Southwest*, U.S. Environmental
23 Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134,
24 ARS/233046.
25

26 Lewis, R.B., and J.T. Hestand, 2006, "Federal Reserved Water Rights: Gila River Indian
27 Community Settlement," *Journal of Contemporary Water Research and Education* 133:34–42.
28

29 Lovich, J., and D. Bainbridge, 1999, "Anthropogenic Degradation of the Southern California
30 Desert Ecosystem and Prospects for Natural Recovery and Restoration," *Environmental*
31 *Management* 24(3):309–326.
32

33 LS Power, 2010, *LS Power Initiates Development of Solar Energy Project near Arlington Valley*
34 *Plant*. Available at <http://www.lspower.com/News/newsArticle030707.htm>. Accessed Oct. 18,
35 2010.
36

37 Ludington, S., et al., 2007, *Preliminary Integrated Geologic Map Databases for the United*
38 *States—Western States: California, Nevada, Arizona, Washington, Oregon, Idaho, and Utah*,
39 U.S. Geological Survey Open File Report 2005-1305, Version 1.3, updated Dec. 2007. Available
40 at <http://pubs.usgs.gov/of/2005/1305/index.htm>.
41

42 Lynch, D.J., 1982, "Volcanic Processes in Arizona," *Fieldnotes from the Arizona Bureau of*
43 *Geology and Mineral Technology* 12(3):1–8. Available at [http://www.azgs.az.gov/hazards_](http://www.azgs.az.gov/hazards_volcanoes.shtml)
44 [volcanoes.shtml](http://www.azgs.az.gov/hazards_volcanoes.shtml). Accessed July 22, 2010.
45

1 Manci, K.M., et al., 1988, *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and*
2 *Wildlife: A Literature Synthesis*, NERC-88/29, U.S. Fish and Wildlife Service National Ecology
3 Research Center, Ft. Collins, Colo.
4

5 Mao, F., 2010, personal communication from Mao (Arizona Department of Environmental
6 Quality, Phoenix, Ariz.) to Y.-S. Chang (Argonne National Laboratory, Argonne, Ill.), July 17.
7

8 Marsh, P., and R. Kesner, 2006, *Analysis of Fish Population Monitoring Data for Selected*
9 *Waters of the Gila River Basin, Arizona, for the Five-year Period 2000–2004*, prepared for
10 U.S. Bureau of Reclamation. Available at [http://www.usbr.gov/lc/phoenix/biology/azfish/pdf/](http://www.usbr.gov/lc/phoenix/biology/azfish/pdf/FnlRpt2000tto2004.pdf)
11 [FnlRpt2000tto2004.pdf](http://www.usbr.gov/lc/phoenix/biology/azfish/pdf/FnlRpt2000tto2004.pdf).
12

13 Martin, P.S., and F. Plog, 1973, *The Archaeology of Arizona: A Study of the Southwest Region*,
14 Doubleday/Natural History Press, Garden City, N.Y.
15

16 Matson, R.G., 1991, *The Origins of Southwest Agriculture*, University of Arizona Press, Tucson,
17 Ariz.
18

19 MCDOT (Maricopa County Department of Transportation), 2010, *Traffic Counts*. Available at
20 http://www.mcdot.maricopa.gov/manuals/trafCounts/counts/o_1a.htm. Accessed July 29, 2010.
21

22 McGuire, R., and M. Schiffer, 1982, *Hohokam and Patayan: Prehistory of Southwestern*
23 *Arizona*, Academic Press, N.Y.
24

25 MIG (Minnesota IMPLAN Group), Inc., 2010, *State Data Files*, Stillwater, Minn.
26

27 Miller, N.P., 2002, “Transportation Noise and Recreational Lands,” in *Proceedings of Inter-*
28 *Noise 2002*, Dearborn, Mich., Aug. 19–21. Available at [http://www.hmmh.com/cmsdocuments/](http://www.hmmh.com/cmsdocuments/N011.pdf)
29 [N011.pdf](http://www.hmmh.com/cmsdocuments/N011.pdf). Accessed Aug. 30, 2007.
30

31 Moose, V., 2009, “Comments on Solar Energy Development Programmatic EIS,” personal
32 communication from Moose (Tribal Chairperson, Big Pine Paiute Tribe of the Owens Valley,
33 Big Pine, Calif.) to Argonne National Laboratory (Argonne, Ill.), Sept. 14.
34

35 Morgan, G.S., and R.S. White, Jr., 2005, “Miocene and Pliocene Vertebrates from Arizona,”
36 pp. 114–135 in *Vertebrate Paleontology in Arizona*, New Mexico Museum of Natural History
37 and Science Bulletin No. 29, A.B. Heckert and S.G. Lucas (editors).
38

39 National Research Council, 1996, *Alluvial Fan Flooding*, Committee on Alluvial Fan Flooding,
40 Water Science and Technology Board, and Commission on Geosciences, Environment, and
41 Resources, National Academies Press, Washington, D.C.
42

43 NatureServe, 2010, *NatureServe Explorer: An Online Encyclopedia of Life (Web Application)*,
44 *Version 7.1*, Arlington, Va. Available at <http://www.natureserve.org/explorer>. Accessed Oct. 1,
45 2010.
46

1 NCDC (National Climatic Data Center), 2010a, *Climates of the States (CLIM60): Climate of*
2 *Arizona*, National Oceanic and Atmospheric Administration, Satellite and Information Service.
3 Available at <http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl>. Accessed
4 July 10, 2010.
5
6 NCDC, 2010b, *Storm Events*, National Oceanic and Atmospheric Administration, Satellite and
7 Information Service. Available at [http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent](http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms)
8 [~Storms](http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms). Accessed July 20, 2010.
9
10 NCES (National Center for Education Statistics), 2009, *Search for Public School Districts*,
11 U.S. Department of Education. Available at <http://www.nces.ed.gov/ccd/districtsearch>.
12
13 Neusius, S.W., and G.T. Gross, 2007, “Mobility, Flexibility, and Persistence in the Great Basin,”
14 in *Seeking Our Past*, Oxford University Press, N.Y.
15
16 NHGC (New Harquahala Generating Company), LLC, 2007, *Harquahala Generating Project*,
17 Jan. Available at [http://www.maricopa.gov/aq/divisions/permit_engineering/permits/docs/title/v](http://www.maricopa.gov/aq/divisions/permit_engineering/permits/docs/title/v/V99015.PDF)
18 [V99015.PDF](http://www.maricopa.gov/aq/divisions/permit_engineering/permits/docs/title/v/V99015.PDF). Accessed Oct. 14, 2010.
19
20 NRC (U.S. Nuclear Regulatory Commission), 2009, *Palo Verde Nuclear Generating Station.*
21 *Applicant’s Environmental Report; Operating License Renewal Stage, April*. Available at
22 <http://www.nrc.gov/reactors/operating/licensing/renewal/applications/palo/palo-envir-rpt.pdf>.
23 Accessed July 29, 2010.
24
25 NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO)*
26 *Database for Maricopa County, Arizona*. Available at: <http://SoilDataMart.nrcs.usds.gov>.
27
28 NRCS, 2010, *Custom Soil Resource Report for Maricopa County (covering the proposed*
29 *Gillespie SEZ), Arizona*, U.S. Department of Agriculture, Washington, D.C., Oct. 7.
30
31 NROSL (Northwest Regional Obsidian Sourcing Laboratory), 2009, *Nevada Obsidian Sources*,
32 April 20. Available at http://www.obsidianlab.com/image_maps/map_obsidian_arizona.jpg.
33 Accessed Aug. 10, 2010.
34
35 Nussear, K.E., et al., 2009, *Modeling Habitat for the Desert Tortoise (Gopherus agassizii) in the*
36 *Mojave and Parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona*,
37 U.S. Geological Survey Open-File Report 2009-1102.
38
39 Ortiz, A. (editor), 1983, *Handbook of North American Indians, Vol. 10, Southwest*, Smithsonian
40 Institution, Washington, D.C.
41
42 Ragsdale, J., 2010, personal communication from Ragsdale (BLM, Lower Sonoran Field Office,
43 Phoenix, Ariz.) to J. May (Argonne National Laboratory, Denver, Colo.), Aug. 3, 2010.
44
45 Reid, J., and S. Whittlesey, 1997, *The Archaeology of Ancient Arizona*, University of Arizona
46 Press, Tucson, Ariz.

1 Richard, S.M., et al., 2000, *Geologic Map of Arizona (Scale 1:1,000,000)*, Arizona Geological
2 Survey Map M-35. Available at http://www.azgs.state.az.us/services_azgeomapve.shtml.
3 Accessed Oct. 20, 2010.
4

5 Robson, S.G., and E.R. Banta, 1995, *Ground Water Atlas of the United States: Arizona,*
6 *Colorado, New Mexico, Utah*, U.S. Geological Survey, HA 730-C.
7

8 Royster, J., 2008, "Indian Land Claims," pp. 28–37 in *Handbook of North American Indians,*
9 *Vol. 2, Indians in Contemporary Society*, G.A. Bailey (editor), Smithsonian Institution,
10 Washington, D.C.
11

12 Russell, F., 1975, *The Pima Indians*, University of Arizona Press, Tucson, Ariz. First published
13 1905.
14

15 SAMHSA (Substance Abuse and Mental Health Services Administration), 2009, *National*
16 *Survey on Drug Use and Health, 2004, 2005 and 2006*, Office of Applied Studies,
17 U.S. Department of Health and Human Services. Available at [http://oas.samhsa.gov/substate2k8/
18 StateFiles/TOC.htm#TopOfPage](http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage).
19

20 Schwartz, S., 2009, "Arizona TES Data Request," personal communication with attachment from
21 Schwartz (HDMS Program Supervisor, Arizona Game and Fish Department, Phoenix, Arizona)
22 to L. Walston (Argonne National Laboratory, Argonne, Ill.), July 29.
23

24 Sempra Generation, 2010a, *Sempra Generation Contracts with GG&E for 150 MW of Solar*
25 *Power*, Oct. Available at [http://public.sempra.com/newsreleases/
26 viewPR.cfm?PR_ID=2536&Co_Short_Nm=SE](http://public.sempra.com/newsreleases/viewPR.cfm?PR_ID=2536&Co_Short_Nm=SE). Accessed Oct. 14, 2010.
27

28 Sempra Generation, 2010b, *Mesquite Power*. Available at [http://www.semprageneration.com/
29 mesquite.htm](http://www.semprageneration.com/mesquite.htm). Accessed Oct. 14, 2010.
30

31 SES (Stirling Energy Systems) Solar Two, LLC, 2008, *Application for Certification*, submitted
32 to the Bureau of Land Management, El Centro, Calif., and the California Energy Commission,
33 Sacramento, Calif., June. Available at [http://www.energy.ca.gov/sitingcases/solartwo/
34 documents/applicant/afc/index.php](http://www.energy.ca.gov/sitingcases/solartwo/documents/applicant/afc/index.php). Accessed Oct. 1, 2008.
35

36 Sheridan, T.E., 1995, *Arizona: A History*, University of Arizona Press, Tucson, Ariz.
37

38 Shipman, T.C., and M. Diaz, 2008, *Arizona's Earth Fissure Mapping Program: Protocols,*
39 *Procedures, and Products*, Arizona Geological Survey Open File Report 08-03.
40

41 Smith, M.D., et al., 2001, "Growth, Decline, Stability and Disruption: A Longitudinal Analysis
42 of Social Well-Being in Four Western Communities," *Rural Sociology* 66:425-450.
43

44 South Phoenix Industry Challenge, 2010, *APS West Phoenix Power Station*. Available at
45 <http://www.phoenixindustrychallenge.com/West%20Phoenix%20Power%20Station.htm>.
46 Accessed July 29, 2010.

1 Spier, L., 1970, *Yuman Tribes of the Gila River*, Cooper Square Publishers, N.Y. First published
2 1933.
3
4 SRP (Salt River Project), 2010, *Agua Fria Generating Station*. Available at
5 <http://www.srpnet.com/about/stations/default.aspx>. Accessed July 29, 2010.
6
7 Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians*, Houghton Mifflin
8 Company, New York, N.Y.
9
10 Stoffle, R.W., et al., 1990, *Native American Cultural Resource Studies at Yucca Mountain,*
11 *Nevada*, University of Michigan, Ann Arbor, Mich.
12
13 Stone, C.L., 1982, "Historical Overview of Central Western Arizona: Non-aboriginal Use of the
14 Desert," in *Granite Reef, A Study in Desert Archaeology*, Brown, P.E., and C.L. Stone (editors),
15 Anthropological Research Paper No. 28, Arizona State University, Tempe, Ariz.
16
17 Stone, C.L., 1986, *Deceptive Desolation: Prehistory of the Sonoran Desert in West Central*
18 *Arizona, Cultural Resource Series No. 1*, Bureau of Land Management, Phoenix, Ariz.
19
20 Stout, D., 2009, personal communication from Stout (U.S. Fish and Wildlife Service, Acting
21 Assistant Director for Fisheries and Habitat Conservation, Washington, D.C.) to L. Jorgensen
22 (Bureau of Land Management, Washington, D.C.) and L. Resseguie (Bureau of Land
23 Management Washington, D.C.), Sept. 14.
24
25 Turner, R.M., and D.E. Brown, 1994, "Sonoran Desertscrub," in *Biotic Communities:*
26 *Southwestern United States and Northwestern Mexico*, D.E. Brown (editor), University of Utah
27 Press, Salt Lake City, Utah.
28
29 United States Army, 2010, *Environmental Assessment for Impact Area Expansion Yuma Proving*
30 *Ground, Arizona*, March. Available at [http://www.yuma.army.mil/docs/](http://www.yuma.army.mil/docs/IAExpansion_EA_Draft_FONSI_25Mar10.pdf)
31 [IAExpansion_EA_Draft_FONSI_25Mar10.pdf](http://www.yuma.army.mil/docs/IAExpansion_EA_Draft_FONSI_25Mar10.pdf). Accessed July 26, 2010.
32
33 UP (Union Pacific) Railroad, 2009, *Allowable Gross Weight Map*. Available at http://www.uprr.com/aboutup/maps/attachments/allow_gross_full.pdf. Accessed March 4, 2010.
34
35
36 URS Corporation, 2006, *Aquatic Communities of Ephemeral Stream Ecosystems*, Arid West
37 Water Quality Research Project, prepared for Pima County Wastewater Management
38 Department with funding by EPA Region IX, Assistance Agreement X-97952101.
39
40 USAF (United States Air Force), 2009a, *Draft EIS Executive Summary, Proposed Range*
41 *Enhancements at Barry M. Goldwater Range East*. Available at [http://www.luke.af.mil/](http://www.luke.af.mil/shared/media/document/AFD-090710-105.pdf)
42 [shared/media/document/AFD-090710-105.pdf](http://www.luke.af.mil/shared/media/document/AFD-090710-105.pdf). Accessed July 30, 2010.
43
44 USAF, 2009b, "Notice of Intent to Prepare an Environmental Impact Statement for Beddown
45 of Training F-35A Aircraft, Dec.," *Federal Register* 74(247): 68597. Available at
46 <http://edocket.access.gpo.gov/2009/pdf/E9-30664.pdf>. Accessed July 30, 2010.

1 USAF, 2010a, *Barry M. Goldwater Range Factsheet*. Available at <http://www.944fw.afrc.af.mil/library/factsheets/factsheet.asp?id=3550>. Accessed July 30, 2010.

2

3

4 USAF, 2010b, *Luke Air Force Base Factsheet*. Available at <http://www.luke.af.mil/library/factsheets/factsheet.asp?id=5047>. Accessed July 30, 2010.

5

6

7 USAF, 2010c, *Luke AFB News*. Available at <http://www.luke.af.mil/news/story.asp?id=123215764>. Accessed July 30, 2010.

8

9

10 U.S. Bureau of the Census, 2009a, *County Business Patterns, 2006*, Washington, D.C. Available at <http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html>.

11

12

13 U.S. Bureau of the Census, 2009b, *GCT-T1. Population Estimates*, Available at <http://factfinder.census.gov>.

14

15

16 U.S. Bureau of the Census, 2009c, *QT-P32. Income Distribution in 1999 of Households and Families: 2000*, Census 2000 Summary File (SF 3)—Sample Data. Available at <http://factfinder.census.gov>.

17

18

19

20 U.S. Bureau of the Census, 2009d, *SI901. Income in the Past 12 Months, 2006–2008 American Community Survey 3-Year Estimates*. Available at <http://factfinder.census.gov>.

21

22

23 U.S. Bureau of the Census, 2009e, *GCT-PH1. GCT-PH1. Population, Housing Units, Area, and Density: 2000*, Census 2000 Summary File (SF 1)—100-Percent Data. Available at <http://factfinder.census.gov>.

24

25

26

27 U.S. Bureau of the Census, 2009f, *T1. Population Estimates*. Available at <http://factfinder.census.gov>.

28

29

30 U.S. Bureau of the Census, 2009g, *GCT2510. Median Housing Value of Owner-Occupied Housing Units (Dollars), 2006–2008 American Community Survey 3-Year Estimates*. Available at <http://factfinder.census.gov>.

31

32

33

34 U.S. Bureau of the Census, 2009h, *QT-H1. General Housing Characteristics, 2000*, Census 2000 Summary File 1 (SF 1) 100-Percent Data. Available at <http://factfinder.census.gov>.

35

36

37 U.S. Bureau of the Census, 2009i, *GCT-T9-R. Housing Units, 2008, Population Estimates*. Available at <http://factfinder.census.gov>.

38

39

40 U.S. Bureau of the Census, 2009j, *S2504. Physical Housing Characteristics for Occupied Housing Units, 2006–2008 American Community Survey 3-Year Estimates*. Available at <http://factfinder.census.gov>.

41

42

43

44 U.S. Bureau of the Census, 2009k, *Census 2000 Summary File 1 (SF 1) 100-Percent Data*. Available at <http://factfinder.census.gov>.

45

46

1 U.S. Bureau of the Census, 2009l, *Census 2000 Summary File 3 (SF 3)—Sample Data*.
2 Available at <http://factfinder.census.gov>.
3

4 USDA (U.S. Department of Agriculture), 2004, *Understanding Soil Risks and Hazards—Using
5 Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property*, G.B. Muckel
6 (editor).
7

8 USDA, 2009a, *Western Irrigated Agriculture, Data Sets*. Available at [http://www.ers.usda.gov/
9 data/westernirrigation](http://www.ers.usda.gov/data/westernirrigation). Accessed Nov. 20, 2010.
10

11 USDA, 2009b, *2007 Census of Agriculture: Arizona State and County Data, Vol. 1*, Geographic
12 Area Series, National Agricultural Statistics Service, Washington, D.C. Available at
13 [http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_L
14 evel/Arizona/index.asp](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Arizona/index.asp).
15

16 USDA, 2010a, *National Agricultural Statistics Service—Quick Stats, Arizona County Data
17 (Crops and Animals)*. Available at [http://www.nass.usda.gov/QuickStats/Create_County_
18 Indv.jsp](http://www.nass.usda.gov/QuickStats/Create_County_Indv.jsp). Accessed July 30, 2010.
19

20 USDA, 2010b, *Plants Database*, Natural Resources Conservation Service. Available at
21 <http://plants.usda.gov>. Accessed June, 23, 2010.
22

23 U.S. Department of Commerce, 2009, *Local Area Personal Income, Bureau of Economic
24 Analysis*. Available at <http://www.bea.doc.gov/bea/regional/reis>.
25

26 U.S. Department of the Interior, 2010, *Native American Consultation Database*, National
27 NAGPRA Online Databases, National Park Service. Available at
28 <http://grants.cr.nps.gov/nacd/index.cfm>.
29

30 U.S. Department of Justice, 2009a, “Table 8: Offences Known to Law Enforcement, by State and
31 City,” *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice
32 Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.
33

34 U.S. Department of Justice, 2009b, “Table 10: Offences Known to Law Enforcement, by State
35 and by Metropolitan and Non-metropolitan Counties,” *2008 Crime in the United States*, Federal
36 Bureau of Investigation, Criminal Justice Information Services Division. Available at
37 http://www.fbi.gov/ucr/cius2008/data/table_10.html.
38

39 U.S. Department of Labor, 2009a, *Local Area Unemployment Statistics: States and Selected
40 Areas: Employment Status of the Civilian Noninstitutional Population, 1976 to 2007, Annual
41 Averages*, Bureau of Labor Statistics. Available at <http://www.bls.gov/lau/staadata.txt>.
42

43 U.S. Department of Labor, 2009b, *Local Area Unemployment Statistics: Unemployment Rates
44 for States*, Bureau of Labor Statistics. Available at
45 <http://www.bls.gov/web/laumstrk.htm>.
46

1 U.S. Department of Labor, 2009c, *Local Area Unemployment Statistics: County Data*, Bureau of
2 Labor Statistics. Available at <http://www.bls.gov/lau>.
3
4 USFS (U.S. Forest Service), 2007, *Wild Horse and Burro Territories*. Available at
5 <http://www.fs.fed.us/rangelands/ecology/wildhorseburro//territories/index.shtml>.
6 Accessed Oct. 20, 2009.
7
8 USFWS (U.S. Fish and Wildlife Service), 1994, *Desert Tortoise (Mojave Population) Recovery*
9 *Plan*, U.S. Fish and Wildlife Service, Portland, Ore.
10
11 USFWS, 2009a, *National Wetlands Inventory*. Available at <http://www.fws.gov/wetlands>.
12
13 USFWS, 2009b, *Final Environmental Assessment Limiting Mountain Lion Predation on Desert*
14 *Bighorn Sheep on the Kofa National Wildlife Refuge*, Dec. Available at <http://www.fws.gov/southwest/refuges/arizona/kofa/docs/KofaMtLionContFinalEA.pdf>. Accessed July 27, 2010.
15
16
17 USFWS, 2010a, *Environmental Conservation Online System (ECOS)*. Available at
18 <http://www.fws.gov/ecos/ajax/ecos/indexPublic.do>. Accessed May 28, 2010.
19
20 USFWS, 2010b, “Endangered and Threatened Wildlife and Plants; 12-Month Finding on a
21 Petition to List the Sonoran Desert Population of the Bald Eagle as a Threatened or Endangered
22 Distinct Population Segment,” *Federal Register* 75:8601–8621.
23
24 USGS (U.S. Geological Survey), 2004, *National Gap Analysis Program, Provisional Digital*
25 *Land Cover Map for the Southwestern United States*, Version 1.0, RS/GIS Laboratory, College
26 of Natural Resources, Utah State University. Available at <http://earth.gis.usu.edu/swgap/landcover.html>. Accessed March 15, 2010.
27
28
29 USGS, 2005a, *Southwest Regional GAP Analysis Project—Land Cover Descriptions*, RS/GIS
30 Laboratory, College of Natural Resources, Utah State University, Logan, Utah.
31
32 USGS, 2005b, *Southwest Regional GAP Analysis Project*, U.S. Geological Survey National
33 Biological Information Infrastructure. Available at <http://fws-nmcfwru.nmsu.edu/swregap/habitatreview/Review.asp>.
34
35
36 USGS, 2007, *National Gap Analysis Program, Digital Animal-Habitat Models for the*
37 *Southwestern United States*, Version 1.0, Center for Applied Spatial Ecology, New Mexico
38 Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available at
39 <http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm>. Accessed March 15, 2010.
40
41 USGS, 2008, *National Seismic Hazard Maps—Peak Horizontal Acceleration (%g) with 10%*
42 *Probability of Exceedance in 50 Years (Interactive Map)*. Available at
43 <http://gldims.cr.usgs.gov/nshmp2008/viewer.htm>. Accessed Aug. 4, 2010.
44

1 USGS, 2010a, *National Earthquake Information Center (NEIC)—Circular Area Search (within*
2 *100-km of the Center of the Proposed Gillespie SEZ)*. Available at [http://earthquake.usgs.gov/](http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php)
3 [earthquakes/eqarchives/epic/epic_circ.php](http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php). Accessed July 22, 2010.
4

5 USGS, 2010b, *Glossary of Terms on Earthquake Maps—Magnitude*. Available at
6 <http://earthquake.usgs.gov/earthquakes/glossary.php#magnitude>. Accessed Aug. 8, 2010.
7

8 USGS, 2010c, *Water Resources of the United States—Hydrologic Unit Maps*. Available at
9 <http://water.usgs.gov/GIS/huc.html>. Accessed April 12, 2010.
10

11 USGS, 2010d, *National Water Information System*. Available at [http://wdr.water.usgs.gov/](http://wdr.water.usgs.gov/nwisgmap)
12 [nwisgmap](http://wdr.water.usgs.gov/nwisgmap). Accessed July 20, 2010.
13

14 USGS and AZGS (Arizona Geological Survey), 2010, *Quaternary Fault and Fold Database for*
15 *the United States*. Available at <http://earthquake.usgs.gov/regional/qfaults>. Accessed Oct. 7,
16 2010.
17

18 WildEarth Guardians and Western Watersheds Project, 2008, *Petition to List the Sonoran Desert*
19 *Tortoise (Gopherus agassizii) under the U.S. Endangered Species Act*, Petition to the U.S. Fish
20 and Wildlife Service, Oct. 9, 2008.
21

22 Wood, C.A., and J. Kienle (editors), 1992, *Volcanoes of North America*, Cambridge University
23 Press.
24

25 WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System*
26 *(EDMS)*. Available at <http://www.wrapeds.org/default.aspx>. Accessed June 4, 2009.
27

28 WRCC (Western Regional Climate Center), 2010a, *Western U.S. Climate Historical Summaries*.
29 Available at <http://www.wrcc.dri.edu/Climsum.html>. Accessed July 10, 2010.
30

31 WRCC, 2010b, *Average Pan Evaporation Data by State*. Available at
32 <http://www.wrcc.dri.edu/htmlfiles/westevap.final.html>. Accessed January 19, 2010.
33

34 Wullenjohn, C., 2010, *Yuma Proving Ground Continues Army’s Area History*. Available at
35 http://www.yuma.army.mil/site_about.shtml.
36

1
2
3
4
5
6
7
8
9
10
11
12
13
14
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